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King Creek Research Natural Area
Cleveland National Forest
Todd Keeler - Wolf
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AN ECOLOGICAL SURVEY OF THE KING CREEK RESEARCH NATURAL AREA, CLEVELAND NATIONAL FOREST, SAN DIEGO COUNTY, CALIFORNIA

A Report Prepared for The Nature Conservancy
by Todd Keeler-Wolf
November 1990

CONTENTS

INTRODUCTION	1
Access	1
PRINCIPAL DISTINGUISHING FEATURES	2
JUSTIFICATIONS FOR ESTABLISHMENT	4
Cuyamaca Cypress	4
Other Rare Plants	5
Gabbroic Soils	6
Disjunct Populations	6
Riparian Growth	7
Meadows	7
Rare Animals	7
PHYSICAL AND CLIMATIC CONDITIONS	7
VEGETATION AND FLORA	8
Flora	8
Vegetation Types	11
Mafic southern mixed chaparral	12
Scrub oak chaparral	16
Coulter pine forest	16
Diegan sage scrub	18
Canyon live oak forest	19
Southern interior cypress forest	19
Valley needlegrass grassland	24
Southern coast live oak riparian forest	25
Open Engelmann oak woodland	27
White alder riparian forest	27
Freshwater seep	27
FAUNA	29
GEOLOGY	30
SOILS	31
CULTURAL VALUES	33

AQUATIC VALUES 33
IMPACTS AND POSSIBLE CONFLICTS 33
Grazing 33
Recreation 34
MANAGEMENT CONCERNS 35
BOUNDARY CHANGES 36
RECOMMENDATIONS 37
REFERENCES 38
APPENDICES 40
1. Vascular Plant List
2. Vertebrate List
3. Climatic Data
4. Vegetation Sampling Data for Cuyamaca Cypress Stands
MAPS
1. Location and Transportation Routes
2. The King Creek RNA
3. Vegetation
4. Soils
5. Cuyamaca Cypress Stations and Fire Map
6. Boundary Changes
PHOTOGRAPHS

INTRODUCTION

The King Creek Research Natural Area (KCRNA) is on the Descanso Ranger District of the Cleveland National Forest. The area was selected and nominated by the Cleveland National Forest as a candidate in 1978 to preserve the only example of the Cuyamaca cypress (*Cupressus arizonica* var. *stephensonii*) target element for the Pacific Southwest Region. Currently, it is undergoing the final steps toward establishment.

The KCRNA as defined in this report covers 1002 acres (405.5 ha) including portions of sections 24 and 25 T14S, R3E and sections 19 and 30 T14S, R4E San Bernardino Base and Meridian (SBBM). The boudaries differ somewhat from those originally proposed by the Forest (see map 6). The approximate center of the KCRNA is at latitude 32° 56' N and longitude 116° 37' W.

Elevations range from about 3630 ft. (1106.4 m) along the southern boundary to about 5800 ft. (1767.8 m) atop the southwestern spur ridge of Cuyamaca Peak for a total elevation difference of 2170 ft. (661.4 m).

Access (reference maps 1 and 2):
The KCRNA is most easily reached from the southwest via the Boulder Creek Road (Forest Road 13S08). This road is paved up to the junction with the Sherilton Valley Road (also known as the Heller Ranch Road) and is a well graded gravel road beyond this point. Following is a descriptive travel log.

From Alpine (Descanso Ranger Station) drive east on Interstate 8 approximately 7 miles (11.2 km) to the junction with State Route 79. Turn north on route 79 and drive approximately 3 miles (4.8 km) to Descanso at the junction of State Highway 79 and Oak Grove Road and turn left. Follow Oak Grove Road approximately 1 mile (1.6 km) to the junction with Boulder Creek Road (13S08). Follow Boulder Creek Road north about 3.5 miles (5.6 km) to the junction of Sherilton Valley Road. From this point, access to the western part of the RNA may be had by continuing about 1.8 miles (2.9 km) to the point where a power line access road (eroded steep 4-wheel-drive) intersects the Boulder Creek Rd. By following this road on foot the northwestern edge of the RNA may be reached in a few minutes.

Access to the southern part of the RNA may be had via the Sherilton Valley Road. Turn on Sherilton Valley Road from Boulder Creek Road. Follow said road onto private land (permission should be obtained from Sherilton Valley Properties, Descanso, CA), approximately 1.2 miles (1.9 km) to Quail Road.

Turn north on Quail Road and drive to its end (0.3 miles , 0.5 km) where the barbed wire fence marking the southern edge of the RNA may be seen. Driving time to either access point from Alpine is about 25 to 30 minutes.

Travel within the RNA is facilitated by the network of fire trails cut as a result of the two fires in the area (1950 and 1970) in the past 40 years . These trails are in some cases overgrown and difficult to follow (most are shown on map 2). However, the northern power line trail (a jeep road often consisting of two or three parallel routes) and the trail beginning at the end of Quail Road are both well defined. The western access route up the power line road is relatively steep over most of its length, but does reach the highest part of the RNA. Access to the lower reaches of the West Fork may be had from this route by following a nearly overgrown fire trail branching off this route to the south about half way up to the summit. This trail joins with the trail running south to the private land (see map 2).

The most direct access to most of the cypress stands is from the private land at the southern edge of the RNA. From this point to the lowest stand of cypress along the West Fork is about a 25 minute walk. An additional 15-20 minute walk up a partially overgrown fire trail brings one to the largest stands of cypress. Cross-country travel throughout the RNA is generally difficult because of the predominantly dense, rigid, woody vegetation. However, some upper slopes and xeric exposures on gabbro are relatively passable due to the low density and stature of chaparral shrubs.

PRINCIPAL DISTINGUISHING FEATURES

Approximately 50 acres (20 ha) of Cuyamaca cypress vegetation exist in the world[1]. About 70 percent of this area (35 acres, 14.1 ha) is included within the KCRNA. The remaining acreage occurs on adjacent State Park land (Scheid and Zedler 1989). The primary objective for this RNA is to establish a reserve for the Cuyamaca cypress, the rarest cypress in California.

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[1] note: reports of Cuyamaca cypress from the Sierra Juarez of Baja California (Moran 1977) are, according to Reveal (1978), in some doubt, possibly representing an additional taxon of *C. arizonica*. These stands are in substantially different environments than those at King Creek and appear vegetatively different. In this report, King Creek is considered the sole locality for the Cuyamaca cypress.

The KCRNA is underlain primarily by gabbroic basement rocks, with small areas of granitic rock in the southern portion. The gabbroic soils of the area support several rare and disjunct species of plants (see justifications and flora sections), including all stands of the Cuyamaca cypress.

The KCRNA occupies part of the upper drainage of the southwest-flowing King Creek. This is a relatively small drainage (about 9 miles [14.5 km] long by 2 miles [3.2 km] wide) heading at the Cuyamaca Peak-Japacha Peak ridge just northeast of the RNA and flowing into Conejos Creek. The western part of the RNA is bounded by the Boulder Creek road and the southern part by private land. Highest elevations are in the northeast near the summit of Cuyamaca Peak and lowest elevations are along the bottom of the West Fork drainage at the southern edge of the RNA.

The RNA contains portions of three sub-drainages of King Creek, the largest of which is the West Fork, extending for about 2 miles (3.2 km) from north to south across the RNA. This drainage is separated by a low divide from the upper main branch of King Creek, which drains a small portion of the eastern part of the RNA. The western part of the RNA is drained by the upper reaches of an unnamed fork of King Creek flowing through the Burney Ranch site west of the Boulder Creek Road (see map 2).

Slopes are generally moderate within the central part of the area, with small areas of gentle topography along the lower portions of the West Fork. Slopes steepen above about 4800 ft. (1463 m) in the upper part of the West Fork drainage. Slopes are also relatively steep throughout the unnamed western drainage of King Creek within the RNA.

Vegetation of the majority of the RNA is dominated by chaparral ranging from scrub oak (*Quercus dumosa*) in relatively mesic sites through southern mafic mixed chaparral co-dominated by Eastwood manzanita (*Arctostaphylos glandulosa*) and chamise (*Adenostoma fasciculatum*) on xeric south slopes. The Cuyamaca cypress occurs primarily in relatively mesic sites within the chaparral matrix, with best developed stands in small rills and on northwest exposures. Gallery forests of coast live oak (*Quercus agrifolia*) and associated trees occur along the mid- and lower stretches of the West Fork. Small dry- to-moist meadows occur in several places along the West Fork drainage. A few small patches of Coulter pine (*Pinus coulteri*) vegetation occur along the ridgetops in the northern part of

the RNA. The upper elevations are dominated by scrubby canyon live oak (*Quercus chrysolepis*) with increasing numbers of Coulter pine, and scrubby California black oak (*Quercus kelloggii*) at the highest elevations.

JUSTIFICATIONS FOR ESTABLISHMENT

Cuyamaca Cypress:

No other place in the world supports native stands of this taxon. Thus, the KCRNA affords the only opportunity to preserve the Cuyamaca Cypress target element for the Pacific Southwest Region RNA system. This species is considered sensitive by the Cleveland National Forest and a species of highest priority (list 1b) by the California Native Plant Society (Smith and Berg 1988).

Confined to the southwest slopes of Cuyamaca Peak in the upper King Creek drainage, this tree, as a result of its rarity and susceptibility to high fire frequencies, exists in a precarious state. The establishment of the KCRNA in conjunction with the protection and management of the remaining stands on the adjacent Cuyamaca Rancho State Park will be the best assurance that this tree will maintain itself in nature. The wilderness designation of the population on State Park land has been an important step in the preservation of the cypress (Scheid and Zedler 1989). However, the portion of the population existing on Forest Service Land requires protection.

Based on genetic allozyme studies of populations of cypress species of western North America (Connie Millar, PSW Geneticist, personal communication May 1990) the Cuyamaca cypress is markedly distinct. It is apparently most closely related to the Tecate cypress (*Cupressus forbesii*) and the Arizona cypress (*C. arizonica*), however based on genetic distance, it is much less closely related to these species than are populations within each species are to each other. Also, based on an index of population and species genetic diversity using 25 loci, the Cuyamaca cypress genetic diversity is remarkably low, especially for southern North American cypresses (Connie Millar, op. cit.) Of the 13 species studied, it has the lowest genetic diversity.

Despite this apparent lack of genetic diversity, this species occurs under variable conditions within the RNA. The Cuyamaca cypress occurs in six relatively discrete groves, five of which are at least partially included

within the KCRNA (see maps 3 and 5). Among these stands are variations in fire history, slope exposure, elevation, substrate, and other features that add variety to the representation of the population (photos 1 and 2). Perhaps the most surprising variation is in its tolerence of moisure regimes. The majority of the individuals occur in relatively xeric chaparral settings on northwest to south-facing exposures. Within these stands the cypress must compete with dense populations of highly adapted xerophytic sclerophylls dominated by resprouting burl-forming manzanita and chamise. Despite the competition from such rapidly resprouting shrubs, the seed-reproducing cypress has come to dominate many of these areas at the expense of the shrubs.

Conversely, the cypress also occurs locally as well-established individuals in riparian areas of the small creeks where water is at the surface for much of the year. These areas are clearly much more mesic than the surrounding chaparral with a number of other woody species present. The largest and the oldest cypress trees occur in such habitat.

Compared to other California cypress species typically associated with chaparral such as Sargent cypress (*Cupressus sargentii*), McNab cypress (*C. mcnabiana*), and Piute cypress (*C. arizonica* var. *nevadensis*), Cuyamaca cypress appears to be the most tolerant of moisture variability (Keeler-Wolf 1983, Keeler-Wolf, pers. observation)

Although the species is tolerant of a number of moitsure conditions and is able to compete well with the surrounding vegetation, poor seed dispersal may be the major problem for this species. This trait may have been exacerbated by unusually high fire frequencies over many years, which reduced the once more widespread taxon to this single population (Scheid and Zedler 1989).

Other Rare Plants:

In addition to the Cuyamaca cypress, the KCRNA supports populations of several other species listed as sensitive or rare by the Cleveland National Forest, the State, or the California Native Plant Society (Smith and Berg 1988). These include the grass *Calamagrostis densa* (Forest sensitive, CNPS list 4), *Diplacus (Mimulus) clevelandii* (CNPS list 4), the lemon lily (*Lilium parryi*) (Forest sensitive, CNPS list 4), the Engelmann oak (*Quercus engelmanii* , CNPS list 4), *Calochortus dunnii* (State listed rare, Forest

Sensitive, CNPS list 1b) and *Brodiaea orcuttii* (Forest sensitive, CNPS list 1b). In addition to these species, *Delphinium hesperium* ssp. *cuyamacae* (State listed rare, Forest sensitive, CNPS list 1b), and *Horkelia truncata* (Forest Sensitive, CNPS list 1b) are known from the immediate vicinity of the KCRNA, though not yet verified from within its boundaries.

Gabbroic Soils:

Most of the unique botanical features of the KCRNA are associated with Las Posas and Boomer soils (USDA 1973). These soils are derived from gabbro, an ultramafic plutonic rock which is high in magnesium and low in calcium. This harsh soil has affected growth of some widespread chaparral species by stunting them and reducing their densities, perhaps allowing certain species tolerant of these conditions to occur here, by virtue of reduced competition (e.g. see Kruckeberg 1954). Species restricted to gabbroic soils in the vicinity of the KCRNA include the endemic Cuyamaca cypress, *Calamagrostis densa, Calochortus dunnii, Delphinium hesperium* ssp. *cuyamacae, Horkelia truncata,* and also include disjunct populations of species such as *Salvia sonomensis*.

Another RNA in San Diego County, the Organ Valley RNA, is also known for its gabbro endemism (Burke 1985). Six taxa considered variously rare or of limited distribution occur at Organ Valley. Of these only two are not known from the vicinity of KCRNA. These are *Senecio ganderi* and *Monardella hypoleuca* ssp. *lanata*. KCRNA has such rare gabbro endemics as Cuyamaca cypress, *Calochortus dunnii*, and *Delphinium hesperium* ssp. *cuyamacae* not known from Organ Valley. Thus, the KCRNA appears to hold an equally if not more impressive set of gabbro endemics than Organ Valley.

Disjunct Populations:

Cuyamaca Peak at 6512 ft. (1984.9 m), approximately 0.25 miles (0.40 km) east of the RNA is the second highest peak in San Diego County. As a result of the high elevations in the RNA, several montane disjunct species occur far from their next nearest occurrences in the Peninsular Ranges. These species include *Salvia sonomensis, Viola lobata, Ceanothus foliosus, Euphorbia palmeri, Lilium pardalinum, Phlox austromontana*, Sugar pine (*Pinus lambertiana*), white fir (*Abies concolor*), and incense-cedar (*Libocedrus decurrens*).

Riparian Growth:

The narrow canyon bottoms of the two main branches of the West Fork of

King Creek support a diverse and well developed gallery forest of coast live oak with scattered additional species such as Coulter pine, Engelmann oak, incense-cedar, big-leaf maple (*Acer macrophyllum*), and large specimens of Cuyamaca cypress. The stretches of permanently flowing water in these drainages supports a true riparian element dominated by white alder (*Alnus rhombifolia*) with sycamore (*Platanus racemosa*), willows (*Salix* sp.) and numerous wet-loving shrubs and herbs. These mesophilic to hydrophilic species contrast sharply with the xeric chaparral and cypress communities occurring adjacent to them. These riparian and semi-riparian woodlands also support such rare species as *Lilium parryi* and a disjunct population of *Lilium pardalinum*.

Meadows:

Several small meadows occur in the KCRNA. As with the riparian vegetation, these areas contrast strongly with the surrounding xeric chaparral and associated vegetation. These meadows are surprisingly variable in moisture content, slope exposure, and species composition. Some approach savanna vegetation with scattered trees of Engelmann and coast live oak. A number of native grasses and herbs are associated with them including the rare *Brodiaea orcuttii* and showy species such as *Linanthus dianthiflorus* (photo 3).

Rare Animals:

Several State listed species of special concern (Steinhardt 1990) have been sighted in the RNA. These include Coopers Hawk (*Accipiter cooperi*), Golden Eagle (*Aquila chrysaetos*), San Diego horned lizard (*Phrynosoma coronatum frontale*) (photo 4), and San Diego mountain kingsnake (*Lampropeltis zonata pulchra*).

PHYSICAL AND CLIMATIC CONDITIONS

The KCRNA lies just west of the crest of the Peninsular Ranges in central San Diego County. One of the two peaks in the county over 6500 ft. (1981 m), Cuyamaca Peak is about 1/4 mile (0.8 km) east of the northeastern boundary of the RNA. King Creek flows into Conejos Creek, draining into the Capitan Grande Reservoir, damming the San Diego River, which in turn, enters the Pacific Ocean at San Diego, approximately 36 miles (58.9 km) west of the RNA.

The upper reaches of King Creek form a shallow, south-facing basin bounded on the east and west by ridges ascending to form the southwest shoulder of Cuyamaca Peak. Below the steep upper slopes of the peak, the terrain drops moderately to the south-southwest (10-30 % gradients). Along this slope King Creek has cut two shallow, roughly parallel channels; the West Fork, and the Main Fork. Both forks are largely dry except during runoff periods. For most of the year water is limited to short flowing stretches below several small creek bed springs rising between 4100 and 4600 ft. (1250-1432 m).

Despite the relatively low rainfall along the coast at San Diego (average rainfall about 10 inches (254 mm) per year), the higher mountains of the county receive substantial moisture from winter storms and sporadic sub-tropical summer disturbances. Thus, rainfall at Cuyamaca Rancho State Park Headquarters about 4870 ft. (1484.4 m) averages 36.6 inches (930 mm) annually. This total is a good approximation of the totals within the RNA, as the park headquarters lies only about 3 miles (4.8 km) northeast of the center of the RNA and is at a similar elevation.

The detailed climatological data by Scheid and Zedler (1989) for the Cuyamaca State Park Headquarters are presented in Appendix 3. These data are based on temperature and precipitation records from 1948 to 1987. To summarize; some rain falls on the average during every month, but November through April are the months with heaviest precipitation. Snowfall accounts for some of this precipitation during the winter months, typically comprising less than one-quarter the total for any given month. Lowest rainfall occurs in June averaging only about 0.15 inches (3.8 mm). Highest rainfall is in March (6.37 inches (162 mm)). Yearly maximum temperatures average about 95 °F (35° C) and yearly minima average about 21.8°F (-12°C). The annual range in temperature is about 73° F (47° C).

VEGETATION AND FLORA

Flora:

The flora of the KCRNA is relatively diverse with 204 taxa known from the area (Appendix 1). Nine of these taxa are considered rare, limited in distribution, or threatened by the Forest Service, the State of California, or the California Native Plant Society (see justifications section). With the exception of the Cuyamaca cypress, which is discussed at length in a later

section, all rare species are briefly discussed below:

Calamagrostis densa: This grass (photo 5) is a common component of the southern mafic mixed chaparral, Coulter pine forest, and the scrubby canyon live oak forest throughout most of the RNA underlain by gabbro. It is the most common grass in the chaparral. Although rarely forming dense stands, it is conspicuous with its coarse tufted stems and stout blades. This species is restricted to soils derived from gabbro in the mountains of the northern Peninsular Ranges, from Orange County to Northern Baja California.

Diplacus clevelandii: This bush monkey flower is another species restricted to the Peninsular Ranges of Southern California and adjacent Baja California. It is locally uncommon in the RNA, occurring on relatively xeric, southern, rocky exposures in the mixed chaparral and up into the rocky areas of canyon live oak on the highest parts of the area.

Brodiaea orcuttii: This species apparently occurs in the meadows of the West Fork of King Creek, but also among the Cuyamaca cypress in at least one of the stands. It has been collected by botanists in the RNA[2]. It is another species limited to the Peninsular Ranges of southern California, but is apparently tolerant of several seemingly divergent habitats including; Cismontane woodland, closed-cone (cypress) coniferous forest, meadows, valley and foothill grassland, and vernal pools. It is threatened by development over parts of its range.

Lilium parryi: The lemon lily occurs regularly in small numbers (typically as isolated individuals) along the riparian zone of the West Fork of King Creek. These areas are usually shaded by coast live oak, California rose, snowberry, and other species (photo 6). The plants do not typically grow in permanently wet areas, but in moist to mesic sites adjacent to the stream channels. This attractive species is restricted to the mountains of Southern California and Arizona and is threatened by horticultural collecting.

Quercus engelmanii: The Engelmann oak is an endemic to the foothill savannas and mountain valleys of southern coastal California. It has been extirpated by development in many areas and is threated by a lack of reproduction in other areas (Scott 1990, Lathrop and Osborne 1990). In the RNA it occurs as isolated individuals along the coast live oak forest lining

[2] information on collections available from rare plant program Cleveland National Forest, Escondito, California.

the West Fork of King Creek up to about 4400 ft. elevation (200 ft. above the highest elevation sites known for the species according to Scott 1990). It also occurs in small groups adjacent to meadow sites in the lower West Fork (mini-savannas). Smaller individuals occur on the moderately steep southwest slopes of shallow granitic soil of the lower West Fork valley.

Numerous putative hybrids between this species and the scrub oak occur in scrub oak chaparral throughout the lower and mid-elevations of the West Fork drainage. These hybrids appear taller than typical scrub oak with whitish furrowed bark and bluish green leaves intermediate in character between the two parent species.

Calochortus dunnii: This is another gabbro endemic of the Peninsular Ranges of San Diego County and adjacent Baja California. It has been collected from the RNA, but the field work for the ecological survey did not verify its presence due to the early date of study. Numerous old stalks of *Calochortus* and basal leaves were noted throughout the southern mafic mixed chaparral from low to high elevations and it is likely that most of these were *C. dunnii*. If so, the local population density of this species is relatively high and the species represents a regular component of the southern mafic mixed chaparral.

Delphinium hesperium ssp. *cuyamacae*: This species has been collected in and adjacent to wet meadows near the headwaters of King Creek. These localities are both within the RNA boundaries and just outside, in State Park land. This subspecies is restricted to gabbroic meadows and grasslands in the mid-elevation areas of the Peninsular Ranges of San Diego and Riverside Counties. It is threatened by development over part of its range.

Horkelia truncata: This species has been collected adjacent to the RNA approximately 1/4 mile (0.4 km) west of the western boundary. It is an endemic to the gabbroic soils of San Diego County and adjacent Baja California. It typically occurs in small discrete stands and may be found along road cuts and other disturbed areas.

Vegetation Types:

The vegetation of the KCRNA and surrounding Cleveland National Forest was mapped by the Cleveland National Forest (US Forest Service 1981). These 1:24,000 scale maps are based on aerial photos with some ground-checking

and are soil-vegetation oriented, with major soil units noted. Within the boundary of the KCRNA eight mapping units are indicated based on dominance by woody species. These include:

1) An upper elevation scrub dominated by Eastwood manzanita, *Salvia sonomensis*, scrub canyon oak (*Quercus chrysolepis* var. *nana*), bare ground, and Coulter pine.

2) An upper slope type just below the previous type with canyon live oak, *Ceanothus palmeri*, Eastwood manzanita, and Coulter pine.

3) An area adjacent to the previous on sw-facing slopes dominated by canyon live oak with *Ceanothus palmeri, Ericameria arborescens* ssp. *parishii,* and Coulter pine.

4) An extensive chaparral at mid and lower elevations dominated by chamise, Eastwood manzanita, *Ceanothus greggii* ssp. *perplexans*, *Salvia sonomensis*, and bare soil.

5) An area on the southeastern side of the RNA dominated by chamise, scrub oak (*Quercus dumosa*), *Ceanothus greggii* ssp. *perplexans*, *Eriogonum fasciculatum*, rock and bare soil.

6) An area on nw-facing slopes dominated by chamise, *Ceanothus greggii* ssp. *perplexans*, scrub oak, Eastwood manzanita, *Ceanothus leucodermis*, rock, and bare soil.

7) An area on the sw-side of the RNA on se-facing rocky exposures dominated by rock, *Eriogonum fasciculatum*, chamise, *Salvia apiana*, and grasses.

8) An area along the lower west fork of King Creek dominated by *Eriogonum fasciculatum*, chamise, grasses, Engelmann oak, and coast live oak.

The above mapping units are not sufficiently detailed and accurate for the purposes of this report (e.g. no cypress, coast live oak, meadow, or riparian vegetation indicated) although they do indicate the trends of vegetation based on variation of soil characteristics.

The vegetation map used in this report (map 3) is organized using the Holland system (Holland 1986). Table 1 indicates the acreage of the various vegetation types recognized within the KCRNA. Following is an account of the major plant associations occurring in the RNA. All scientific names are in accordance with Beauchamp (1986), and code numbers following the association names are Holland (1986) type numbers. The associations are listed in decreasing order of size. For Kuchler (1966), SAF (Eyre 1980), and Holland equivalents see map 3.

Mafic Southern Mixed Chaparral (37122): This is a low chaparral dominated by Eastwood manzanita (*Arctostaphylos glandulosa* ssp. *glandulosa*) and chamise (*Adenostoma fasciculatum*). It occupies relatively xeric exposures on south, west, or east aspects on gabbro. The two dominants are augmented with a number of other shrubs including *Ceanothus greggii* ssp. *perplexans* , holly-leaf red berry (*Rhamnus ilicifolia*), Cleveland's sage (*Salvia clevelandii*), *Ceanothus oliganthus* , toyon (*Heteromeles arbutifolia*), among others.

The openings as well as the semi-shaded areas beneath the shrubs are frequently covered with mats of the prostrate or creeping sage (*Salvia sonomensis*) (photo 7). Other understory species of importance are *Calamagrostis densa, Calochortus* sp. (probably mostly *C. dunnii*), *Allium campanulatum, Sanicula tuberosa, Lomatium dasycarpum, Pellaea mucronata,* and *Yucca whipplei* . Table 2 indicates the average cover and frequency of species on 1200 m^2 sampled in this association.

This chaparral is a relatively low open type, averaging about 2.5-3 ft. (0.76-0.91 m) in height, despite the relatively long interval since most of it was last burned (1950). The low stature and the wide spacing of the shrubs reflects the harsh growing conditions on gabbroic soils (photo 8).

Table 1: Area by cover types for KCRNA (with code numbers, see map 3).

	percent total	acres	hectares
HOLLAND TYPES (Holland 1986)			
Diegan Sage Scrub (32500)	6.1	61	24.7
Mafic Southern Mixed Chaparral (37122)	49.0	491	198.7
Scrub Oak Chaparral (37900)	22.9	229	92.7
Valley Needlegrass Grassland (42110)	2.5	25	10.1
Freshwater Seep (45400)	0.1	1	0.4
Southern Coast Live Oak Riparian Forest (61310)	2.2	22	8.9
White Alder Riparian Forest (61510)	0.2	2	0.8
Open Engelmann Oak Woodland (711810)	0.5	5	2.0
Canyon Live Oak Forest (81320)	5.2	52	21.0
Southern Interior Cypress Forest (83330)	3.4	34	13.8
Coulter Pine Forest (84140)	8.0	80	32.4
unclassified	0	0	0
Total	100.1	1002	405.5
SAF TYPES (Eyre 1980)			
Canyon live oak (SAF 249)	5.2	52	21.0
California coast live oak (SAF 255)	2.2	22	8.9
unclassified	92.6	928	375.6
Total	100.0	1002	405.5
KUCHLER TYPES (Kuchler 1966)			
California oakwoods (K26)	7.4	74	29.9
Chaparral (K29)	71.9	720	291.4
Coastal sagebrush (K30)	6.1	61	24.7
California steppe (K41)	2.5	25	10.1
unclassified	12.1	122	49.4
Total	100.0	1002	405.5

Table 2: Frequency and cover values for southern mafic mixed chaparral on six 200 m ^{2} plots.

species	mean percent cover	frequency
Adenostoma fasciculatum	38.8	1.00
Arctostaphylos glandulosa	15.5	1.00
Ceanothus greggii perpelxans	5.3	1.00
Salvia clevelandii	3.5	0.50
Salvia sonomensis	2.3	0.67
Rhamnus ilicifolia	1.5	1.00
Yucca whipplei	1.3	0.50
Heteromeles arbutifolia	1.0	0.33
Trichostoma parishii	0.8	0.33
Allium campanulatum	0.8	0.33
Calamagrostis densa	0.3	0.67
Quercus dumosa	0.3	0.17
Ceanothus oliganthus	0.2	0.17
Calochortus sp.	0.0	0.50
Hazardia squarrosus grindelioides	0.0	0.33
Diplacus clevelandii	0.0	0.17
Lomatium dasycarpum	0.0	0.17
Lonicera subspicata johnstonii	0.0	0.17
Pellaea mucronata	0.0	0.17
Sitanion hystrix	0.0	0.17
Yucca schidigera	0.0	0.17

The wide spacing is most pronounced in a high elevation variant of this community, dominated by low shrubs of Eastwood manzanita and *Ceanothus foliosus*, with mats of creeping sage and occasional stunted individuals of canyon live oak and Coulter pine. This occurs in the saddle area near the highest part of the RNA at about 5600 ft. (1949 m). This type occurs adjacent to the uppermost stand of cypress and an open stand of Coulter pine and is characterized by as much as 50% bare ground. It was burned in 1970. The soil here is rocky and shallow and coupled with its harsh chemical properties is a particularly inhospitiable substrate for most plants (photo 9).

Variation in dominant species is present to a lesser degree throughout the lower and middle elevations of the RNA within this vegetation type. Chamise appears to be strongly dominant on relatively stable (moderately-sloping) south-facing slopes, while Eastwood manzanita tends to dominate over chamise on relatively rocky or steep sites. Species such as *Ceanothus oliganthus* and *Salvia clevelandii* are most common at lower elevations, dropping out above ca. 4800 ft. (1463 m). Distrubed areas along fuel breaks within this vegetation type also contain several characteristic species including *Helianthemum scoparium* var. *aldersonii, Gutierrezia californica, Helianthus gracilentus,* and *Hazardia squarrosus* ssp. *grindelioides*.

Slow growth of the dominants is indicated by the low height of the chaparral in many areas where the above-ground vegetation is over 40 years old. In many areas of southern California on other than gabbro parent material, species such as chamise and Eastwood manzanita frequently attain heights of 6 ft. (2 m) in similar lengths of time. At KCRNA, however, on gabbro these species are often only 18-36 inches tall (46-61 cm).

This community grades into scrub oak chaparral on more mesic aspects, into canyon live oak forest at upper elevations, coast live oak forest in low ravines, and Diegan sage scrub on extremely shallow, well-drained soils.

Compared to the chaparral vegetation of Organ Valley, another largely gabbroic RNA several miles to the northwest (Burke 1985), KCRNA has less area strongly dominated by chamise and more area of true mixed phase chaparral and scrub oak dominated chaparral (see next vegetation type). Organ Valley occupies elevations averaging ca. 1000 ft (305 m) lower than

King Creek and hence has several lower elevation chaparral species apparently absent from King Creek including *Arctostaphylos glauca, Ceanothus tomentosus, Rhus laurina, Nolina parryi,* and *Prunus ilicifolia*.

Scrub Oak Chaparral (37900): Scrub oak (*Quercus dumosa*) is the dominant of this relatively mesic chaparral occurring on north aspects and surrounding ravine bottoms throughout much of the RNA on both gabbroic and granitic soils. This chaparral is made up of taller shrubs than the previous type with average heights of 6-10 ft. (1.8-3.1 m). In addition to scrub oak, other large shrub species such as *Ceanothus leucodermis, Cercocarpus betuloides, Rhus ovata, Arctostaphylos pungens*, and *Ribes indecorum* add to the diversity of the vegetation. Chamise and Eastwood manzanita are common and may co-dominate with scrub oak on west and east exposures on gabbro. Hybrid Engelmann and scrub oaks may comprise up to 10% cover in some areas. These hybrids are taller (up to 20 ft., 6.1 m) than typical scrub oaks with lighter colored and more furrowed bark. Leaf color is similar to Engelmann oak, but shallow pointed lobes or dentitions are present on the leaf margins. Several woody climbing or sprawling species such as *Galium angustifolium, Clematis lasiantha, Marah macrocarpus, Toxicodendron diversilobum*, and *Lonicera subspicata* are present. Due to the taller and denser canopy there is less understory development than in the previous type. A grayish green foliose lichen (*Xanthoparmelia* sp.) makes up 10-15% of the ground cover on steep rocky northwest-facing slopes on gabbro.

Species composition on gabbro is somewhat different than on granitics with scrub oak, chamise and Eastwood manzanita all averaging about 15-20% cover and other species typical of the mafic mixed chaparral such as *Ceanothus greggii* ssp. *perplexans*, *Salvia sonomensis*, and *Calamagrostis densa* present.

Species composition on granitic substrates is strongly dominated by scrub oak (averaging 40% on two plots) with relatively low densities of Eastwood manzanita and chamise. Other species absent from chaparral on gabbro soils are *Ceanothus leucodermis*, *Solidago californica,* and *Stipa* sp.

In general, the understory species are transitional between the mafic mixed chaparral and the more mesic communities such as coast live oak forest.

Coulter Pine Forest (84140): This vegetation, dominated by Coulter pine, is variable in its tree stature, density, and subordinate species composition. This variability arises from: 1) the scattered occurrence of the stands of Coulter pine ranging from about 4000 ft. (1219 m) on lower slopes to 5800 ft. (1768 m) on the highest parts of the RNA, 2) the variation in fire history of these stands, and 3) the variation in soil type. These stands occur within a matrix of mafic chaparral, scrub oak chaparral, and canyon live oak forest. Lower elevation stands are dominated by trees up to 2 ft. (61 cm) in diameter (dbh) and up to 60 ft. (18 .2 m) tall. Understory species are commonly derived from the surrounding mafic mixed chaparral and include Eastwood manzanita, chamise, *Ceanothus greggii* ssp. *perpelexans*, *Calamagrostis densa, Salvia sonomensis,* and *Yucca whipplei*. At higher elevations other species such as *Rhamnus californica* ssp. *tomentosus*, *Viola lobata,* and *Ceanothus foliosus* become common constituents.

The density of understory species is strongly regulated by the density and crown cover of the Coulter pines. The higher the crown cover (shading), the lower the understory density. One plot with an average density of 550 Coulter pines per ha averaged 29% cover by understory species, while one plot with an average density of only 100 trees/ha had average understory cover of 84%.

Species relatively tolerant of shade include *Tauschia parishii, Rhamnus californica,* and *Solidago californica*; while intolerant species include most of the chaparral dominants such as chamise, Eastwood manzanita, *Ceanothus oliganthus*, and *Salvia sonomensis*.

The largest stand of Coulter pine is a very open one at the summit area between 5600 and 5800 ft (1707-1768 m). This stand is underlain by rocky, shallow Boomer soils. It was burned in the Boulder Fire of 1970 and the trees are relatively small and slow growing. Few survivors of the fire exist and most are less than 20 years old, averaging about 15 ft. (4.6 m) tall. These trees are scattered over the saddle growing with 10 ft. (3.1 m) tall resprouts of canyon live oak, smaller multi-stemmed resprouts of California black oak (*Quercus kelloggii*), and shrubs of *Rhamnus californica* ssp. *tomentosus*, *Ceanothus foliosus,* and *Ericameria arborescens* ssp. *parishii*. Several of the understory species are largely unique to this high elevation, open site. These include: *Phlox austromontana, Euphorbia palmeri, Castilleja martinii, Lilium humboldtii var. bloomerianum, Garrya fremontii, Hieracium albiflorum,* and *Lotus*

crassifolius.

Also associated with this upper elevation Coulter pine stand are occasional saplings of conifers such as incense-cedar, white fir, and sugar pine derived from mature individuals on the adjacent north-facing slopes outside of the RNA. Apparently a number of mature trees of these species occurred in this part of the RNA prior to the 1970 fire.

The age structure of the Coulter pine stands is strongly dependent on the influence of substrate on past fire effects. Several small islands of mature trees with few young individuals occur in the mafic mixed chaparral, while other stands are dominated by relatively small trees occurring in high densities. The mature islands are associated with relatively rocky soil where chaparral shrub densities are relatively low and bare soil and/or rock cover is relatively high (photo 10). Thus, fuel levels are low. When fire passed through these areas, the Coulter pines were not destroyed. The mature trees in such stands are typically over 80 years old, about 2 ft. (61 cm) dbh, and about 50-60 ft (15.2-18.2 m) tall.

Many of the trees in denser stands are the first generation after the 1950 Conejos Fire (photo 11). These individuals average about 29 years old (range of five sampled 12-37) and are presently about 8-11 inches (20-28 cm) dbh and about 25 ft. (7.6 m) tall. The few survivors in these burned stands are 60 to 80 years old, 20-22 inches (51-56 cm) dbh, and 35-40 ft. (10.7-12.2 m) tall. Apparently the last fire prior to the 1950 was about 1910.

Thus, as a result of substrate characteristics, the demographics of the Coulter pine stands vary. Rocky, open sites have longer generation times and greater total ages, while less rocky sites have shorter generations and smaller maximum ages. The maximum ages attained by Coulter pine locally are probably not over 150 years. Some large individuals occur in the coast live oak groves adjacent to the major ravines in the King Creek drainage. These are isolated individuals which colonized long ago as a result of perhaps the last major fire to affect this vegetation. Most mature Coulter pines in the area have rotten cores.

Diegan Sage Scrub (32500): This association occurs on shallow excessively well-drained soils on southerly exposures either on granitic or gabbroic

soils. The dominant species include white sage (*Salvia apiana*), *Eriogonum fasciculatum, Yucca whipplei, Gutierrezia californica, Penstemon centranthifolius, Lupinus* sp., and *Clarkia* sp. Sage scrub vegetation occurs sporadically on the gabbroic soils of the area, usually as small patches of less than 1 acre (0.4 ha). It frequently forms a border around the meadows along the West Fork of King Creek (photo 12).

The most extensive stands of sage scrub occur on shallow granitic soil on the southeast facing slopes of the lower West Fork drainage. Here it surrounds granitic slabs and has such rock-dwelling species as *Selaginella bigelovii, Dudleya pulverulenta,* and *Opuntia littoralis var. vaseyi* associated with it. This area is actually a matrix zone with sage scrub dominating on the shallowest soils adjacent to the granitic slabs and scrub oak chaparral, and in some cases Engelmann oak woodland dominating immediately adjacent to these patches on slightly deeper soils (see following sections).

Canyon Live Oak Forest (81320): This plant community is restricted to the higher elevations of the RNA above about 4800 ft. (1463 m). Here it occurs as a scrubby forest of varying density on steep to relatively gradual slopes. The scrubby stature of the trees is a result of this area being burned once in 1950 and again in 1970. At present, the trees are about 10-15 ft. (3.1-4.6 m) tall and are typically multi-stemmed. These resprouts are associated with several other woody species, the most widespread and common of which are *Rhamnus californica* ssp. *tomentosa*, Coulter pine, *Ceanothus leucodermis*, *Ceanothus palmeri, Mahonia dictyota*, and scrub interior live oak (*Quercus wislizenii* var. *fructescens*). Understory species include *Solidago californica, Bromus* sp. (perennial native), *Galium andrewsii,* and *Monardella* sp.

Southern Interior Cypress Forest (83330): This is the generic name of the forest locally dominated by Cuyamaca cypress. Hardly a forest, and typically better described as a scrub, as with the Coulter pine forest, this community has a high degree of variability. In its most extensive, pure form it occurs within a matrix of southern mafic mixed chaparral with species such as Eastwood manzanita and chamise as the typical sub-dominants. However, Cuyamaca cypress also may occur as riparian gallery stands adjacent to coast live oak or white alder riparian vegetation. Based on sampling transects within the five stands on public lands (Scheid and Zedler

1989) the principal associates of cypress also include *Ceanothus greggii* ssp. *perplexans*, scrub oak, toyon, and *Salvia sonomensis*.

The largest cypress individuals occur in the mesic-to-hydric riparian areas along the upper reaches of the West Fork of King Creek. Several of these trees are about 40 ft. (12.2 m) tall and up to 28 inches (71 cm) in diameter (photo 13). The densest stands occur within mesic microsites surrounded by chaparral, as in small rills and on northwest facing aspects. These densely packed individuals average between 6 and 10 ft. (1.8-3.0 m) tall and between 2 and 3 inches (5.1-7.6 cm) in diameter (at 10 cm above base). Cypress densities in chaparral average between 1700 and 2630 per acre (4200 - 6500/ha), while stream-side stands average 304/acre (750/ha) (Scheid and Zedler 1989). Using these density figures, the population size on Forest Service land is between 46,000 and 70,000 individuals, while total population size is between 71,000 and 108,000 individuals.

Understory species of the chaparral stands include many of the same species found in mafic mixed chaparral. One species that is particularly noteworthy in the stands on northwest exposures is the orchid *Habenaria elegans*. The rare *Brodiaea orcuttii* is also known from cypress stands. Species associated with the riparian stands are shared with the white alder riparian association (see following section).

Because of the extensive sampling of all cypress stands performed by Scheid and Zedler (1989) no additional vegetation sampling was done for this survey. Appendix 4 reproduces much of the data presented in Scheid and Zedler.

The population is divided into six stations, two of which are further divided into sub-stations (indicated by lettering following the station number). Map 5 shows the distribution of all the cypress stands (stations) in the population with their numbering as described in Reveal (1978) and Scheid and Zedler (1989). Map 5 also shows the area burned by the two fires known from the area since fire records began.

The sampling by Scheid and Zedler was undertaken primarily to understand the important influences on the reproductive ability, and hence, survivorship of the Cuyamaca cypress. Population structure was analyzed by measuring a number of trees from each station (height and diameter). Cone production was sampled at each station by counting the number of immature, mature,

and open mature cones for a number of trees. Tree size and cone production were compared throughout the population. Based on these data, estimates of reproductive capacity for each cypress station was calculated.

Cone production was lowest at stands where trees were the most stunted (stations 2b and 3a) and highest in station 2a, and those stations along the drainages along the branches of King Creek (all stations with large and/or old trees).
In general, trees were found to be larger when growing in or near drainages than in the chaparral, and despite location, older trees tended to be larger. According to Scheid and Zedler, the younger trees of mesic drainages do produce more cones than comparably ages trees of chaparral sites, but as the trees get older (samples from trees that were survivors of the 1950 fire and thought to be at least 90 years old), the chaparral individuals supported more cones. This was thought to be a factor of increased shading with age at the drainage sites, as shading strongly suppresses cone production (Scheid and Zedler, op. cit.). This point is taken to its extreme at station 6 outside of the RNA on private land. At this station, most of the cypresses are not producing cones and are in a heavily shaded understory of coast live oak. In the drainages where cypress occurs in the RNA, shrub density is lower than in chaparral stands and cypress have better crown development and therefore have higher cone and seed production. Unlike the situation at station 6, cypress and coast live oak are negatively associated throughout the drainageways of the RNA, thus cypress is typically its own principal competitor.

Competition from chaparral shrubs is hypothesized to reduce the cone and seed production from trees in these areas. However, cypress is competetively superior to the dominant chaparral species, and with time will overtop and shade them out. As in the drainages, it is hypothesized that cypress competes most heavily with itself.

The extremely high densities of cypress individuals in some chaparral stands points to highly competitive situations. Yet, the survivorship (barring fire) is remarkably high for these crowded stands. Scheid and Zedler note that in station 4 some trees that germinated following the 1950 fire are dying presumably due to overcrowding. However, most of the high-density stands exhibit high (>90%) survivorship. Despite the drought

conditions in the 4 years prior to this report (1990), no recent deaths were noted by this observer in either of the high density stands (stations 3c and 4).

Of all the factors measured by Scheid and Zedler, tree diameter was the best single predictor of cone production. However, tree density can confound this relationship. Where tree densities are high (as in the chaparral stands burned in 1950) the number of cones is reduced per tree regardless of size. Nonetheless, if measured on a per unit area basis, high tree density does not negatively affect cone production (i.e., the lower number of cones per tree is compensated by the higher density of trees per unit area).

The trees germinating since the 1970 fire (stations 3a and 3b) have poor production of cones and are small and of low density. Scheid and Zedler hypothesize that this is related to the differences in density (the 1970 fire burned trees that were only 20 years old for the most part and had few cones). as well as age-related size differences, topographic position, and the degree of parasitism of young cones.

Scheid and Zedler suggest that the Cuyamaca cypress population exibits characteristics of a declining population. They cite the fact that most of the individuals are limited to drainages with relativley few occurring on upper slopes. The believe that a trend toward higher than optimum fire frequencies in the area has restricted the species to a stronghold in drainages where fire frequencies are relatively low.

Several factors not addressed by Scheid and Zedler may also be important in the distribution of the cypress and in its survivorship. One factor involves the restriction of this species to gabbro soils. Although not as chemically harsh as the related ultramafics such as peridotite and serpentinite, gabbro has a distinct negative effect on the growth of widespread species such as chamise and Eastwood manzanita. This is manifested in the relatively low stature of the shrubs (see mixed mafic chaparral discussion) and in the relatively wide-spacing of the individuals (bare ground averages about 15% in sample plots, and may be up to 50% in some cypress stands). This cover reduction translates into a relatively low fuel build-up even over long intervals between fires. This low fuel load and low cover is likely to be advantageous to the cypress population. It has been shown that extremely intense chaparral fires have a negative effect on cypress populations

(Zedler 1977, Reveal 1978), killing the seeds as well as the stems. Thus, chaparral on gabbro has a lower likelihood of carrying destructive fire than non-gabbroic chaparral. Over the years this has probably been an important determinant of the restriction of Cuyamaca cypress as well as Tecate cypress (Gautier and Zedler 1980) to the gabbroic soils of San Diego County.

Scheid and Zedler have stressed the importance of competition from other shrubs as a negative effect on the growth rates and development of the Cuyamaca cypress. They suggest that thinning of the competing vegetation in the cypress stands would likely have a positive influence on cypress growth. A subjective view of surrounding chaparral vegetation of the same age off of gabbro suggests that shrub cover and height is substantially greater. It seems likely that Cuyamaca cypress would be much less likely to colonize and dominate a more vigorous non-gabbroic chaparral.

Another point not discussed by Scheid and Zedler is the apparent correlation between variation in moisture and cone production. Based on limited data there is a strong correlation between number of cones on trees of the same age and the slope position they occupy. Based on 21 trees sampled in chaparral stands in station 3b, ranging from south to northwest exposures, there was an increase in cone production from south to north with the most mesic northwest exposures supporting the most productive trees ($r= 0.85$, $p=0.05$).

These cones, as with most cypresses, are arranged in clusters around the main stems (photo 14). Those individuals of more mesic sites exhibited a higher number of cone clusters than individuals on xeric sites ($r=0.92$, $p<0.01$). This suggests that the number of favorable years for cone production are higher on mesic sites than on xeric sites at least for relatively young trees of the same age. This observation supports another reason why cypresses are restricted to relatively mesic sites under a regime of relatively high fire frequency: there appears to be a greater likelihood of cypress producing a sufficient seed bank in a shorter period of time in mesic sites.

An intriguing question arising from these opservations is precisely how is cone production regulated? Although Cuyamaca cypresses have the potential of producing cones after only 6-7 years of growth, this potential is highly variable from year to year. By associating the number of cone clusters with

the number of nodal branches it is possible to get an estimate of the number of good and bad reproductive years for an individual cypress. The mean number of cone clusters for 40-year-old nw-facing slope trees was 6.4 (n=7) while mean the number of clusters for s-facing trees of the same age averaged 1.4 (n=7). Based on nodal branch counts, it appears that the last series of good reproductive years for xeric cypress was the high rainfall year of 1982-83. It thus seems likely that climatic factors are responsible, but their precise effects remain to be elucidated (moisure at what times of the year?, pollination takes place in the fall, do moisture conditions at this time have an effect on cone set? is the previous year's moisture availability important?, is there a threshold level of moisture that stimulates cone production, etc.).

Although Cuyamaca cypress is thought of as an obligate fire reseeder, there are occasional trees with cones that open without fire and produce seeds that germinate and grow without fire. Several seedlings were noted in the west- facing chaparral stand 3c. These were easily distinguished by the immature foliage and non-stunted habit (photo 15) and were probably under 5 years old. In addition, a few young trees from 5 to 17 years old were associated with drainage-bottom stands along the West Fork. It is unlikely that the very low percentage of individuals that germinate and grow into seed-bearing trees without fire or soil disturbance does much to maintain the population. However, it is a strategy that may help sustain and even extend populations during periods of very low fire frequency. This strategy may have been much more valuable to Cuyamaca cypress during times of moister climates (e.g. Pliocene) when the taxon may have been more widespread. Similar seeding without fire has also been noticed for Sargent cypress in mesic areas (Keeler-Wolf 1983).

Much information now exists on the characteristics of the individual cypress stands in the KCRNA (Rathburn, 1965, Reveal 1978, Scheid and Zedler 1989). This information coupled with the previously available information on the response to fire and variation of fire frequencies of this species and related species of cypress provide a strong basis for effective management of this rare endemic taxon (see management concerns section).

Valley Needlegrass Grassland (42110): Although this community is limited to five or six small patches in the RNA, totaling about 25 acres (10.1 ha), it is diverse. Each small meadow is different in several ways, with relatively few dominant species shared between all sites (photo 16). Although Reveal

(1978) and Sheid and Zedler (1989) call these meadows *Muhlenbergia* meadows, deergrass (*Muhlenbergia rigens*) is not a dominant in all of them. The variation between meadows is dependent upon differences in substrate, moisture, elevation, slope, and degree of disturbance. Perennial grasses and grasslike species are important constituents of most of these meadows and, in addition to deergrass, include *Bromus breviaristis, Koeleria macrantha, Stipa* sp., *Juncus macrophyllus,* and *Sitanion hystrix*. A number of annual and perennial herbs are numerous in these areas as well. Some of the more conspicuous include; *Linanthus dianthiflorus* (photo 3), *Sanicula bipinnitifida, Trifolium depauperiatum, Sisyrinchium bellum, Gilia capitata, G. australis, Plantago erecta, Orthocarpus purpurascens, Layia* sp., and *Hemizonia fasciculata*.

The number of weedy species appears to increase with decreasing elevation. Species such as *Erodium cicutarium, E. botrys, Hypochoeris glabra, Bromus rubens, B. diandrus, B. mollis,* and *Medicago polymorpha* appear more common in the lower West Fork meadows near the edge of the private land. The degree of disturbance may also be higher in these lower meadows. Although no recent evidence of livestock grazing exists in any of these meadows, the lower ones have more open ground, higher densities of gopher mounds, and greater erosion problems (see impacts).

The meadows have relatively deep and rock-free soil, distinguishing them from the surrounding chaparral vegetation. Moisture availability is variable, ranging from relatively high to relatively low. In some cases there is a central portion associated with a drainage or a seep having a core of hydrophilic species. These core areas support transitional vegetation between the dry meadow type and the freshwater seep vegetation (see freshwater seep section), including *Carex spissa, Potentilla glandulosa*, and other hydrophilic species. Other meadows are dry, with no evidence of surface moisture.

Seven 1 m^2 plots were sampled in a dry meadow along the West Fork. Thirty-two species were encountered on these 7 plots. Table 3 shows the average cover and frequency of species encountered.

Southern Coast Live Oak Riparian Forest (61310): This gallery forest occurs in intermittent strips surrounding the mesic bottomland adjacent to the West Fork of King Creek (photo 17). It is the only closed canopy forest Table

3: Cover and frequency values for herbaceous vegetation on seven 1 m^2 plots in meadow (Valley needlegrass grassland) vegetation King Creek RNA.

species	mean percent cover	frequency
Stipa sp. (probably *S. lepida*)	17.1	0.86
Plantago erecta	11.0	1.00
Sanuicula bipinnitifida	9.0	1.00
Hemizonia sp. (probably *fasciculata*)	8.6	1.00
Erodium cicutarium	3.3	0.71
Sisyrinchium bellum	3.7	0.57
Vulpia myuros	3.9	0.29
Erodium botrys	3.7	0.57
Linanthus dianthiflorus	3.6	0.29
Bromus rubens	1.9	0.29
Hypochoeris glabra	2.4	0.71
Brodiaea sp.	1.6	0.71
Trifolium depauperatum truncatum	1.6	0.86
Bromus tectorum	1.4	0.14
Lotus sp. (annual)	0.9	0.57
Corethrogyne filiginifolia glomerata	0.7	0.43
Layia sp. (probably *platyglossa*)	0.7	0.14
Eriogonum fasciculatum	0.7	0.14
Yucca whipplei	0.7	0.14
Lupinus sp. (annual)	0.6	0.43
Orthocarpus purpurascens	0.6	0.43
Lomatium dasycarpum	0.4	0.29
Calandrinia ciliata menziesii	0.3	0.29
Cordylanthus filifolius	0.3	0.14
Sidalcea malviflora sparsiflora	0.3	0.14
Crassula connata	0.1	0.14
Gilia capitata	0.1	0.14
Hymenothrix wrightii	0.1	0.14
Lepidium nitidum	0.1	0.14
Plagiobothrys tenellus	0.1	0.14
Plagiobothrus californicus fulvescens	0.1	0.14
Camissonia confusa	tr.	0.14

dominated by large trees in the RNA. The groves of coast live oak form arching canopies over a shady and mesic understory dominated by such species as *Symphoricarpos mollis, Mahonia dictyota,* poison oak *(Toxicodendron diversilobum), Sanicula graveolens, Galium aparine, Viola purpurea,* and *Elymus glaucus* .

Coast live oak is the clear dominant with individuals attaining 4 ft. (1.2 m) dbh and spreading crowns up to 60 ft. (18.2 m) across.

Four 10 x 10 m plots were sampled in the coast live oak forest along a branch of the west fork of King Creek . The density of coast live oak stems over 2 m tall in this area averaged 725/ha (293.4/acre). The basal area cover averaged 81.5 m^2/ha (355 ft^2/acre). The only other tree in the sample was a single Coulter pine. Based on this sample, Coulter pine averages 25 trees/ha and 5.6 m^2/ha (24.4 $ft.^2$/acre). Table 4 summarizes the understory species cover and frequency for this sample.

In addition to Coulter pine, occasional individuals of incense-cedar, big-leaf maple, California black oak, and Engelmann oak also occur in the coast live oak forest. The Engelmann oaks are noteworthy because they may occur up to 4400 ft. (higher than mentioned in Scott 1990) and they represent the largest individuals of the species locally (3 ft. (1 m) dbh and 50 ft. (15 m) tall). Although Cuyamaca cypress occurs in the drainages adjacent to these live oak groves, this species is negatively associated with the denser stands of oak because of the cypress' intolerance to shade (see discussion of cypress vegetation). By virtue of its mesic valley bottom location, the best developed portions of the coast live oak community have likley been spared from any crown fire for perhaps over 200 years.

Open Engelmann Oak Woodland (711810): This association is limited to the lower West Fork drainage where it occurs primarily on east and southeast-facing slopes. It is a mixed woodland co-dominated by Engelmann oak, coast live oak, and scrub oak. Dominant trees are small (15-20 ft, 4.5-6 m tall) and relatively spindly. Soil is shallow and derived from granite. Associated species are a mixture of Diegan sage scrub (e.g. *Salvia apiana, Eriogonum fasciculatum*) and scrub oak chaparral (*Quercus dumosa, Rhus ovata, Ceanothus leucodermis* , chamise, poison oak). This stand is similar to the description of the white sage - Engelmann oak woodland in Organ Valley (Burke 1985). At the base of this stand on the ecotone with dry meadow are

Table 4: Cover and frequency values for understory species on four 100 m^2 plots in coast live oak woodland, King Creek RNA.

species	mean percent cover	frequency
Symphoricarpos mollis	45.00	1.00
Mahonia dictyota	10.75	0.75
Fragaria californica	2.25	0.25
Arctostaphylos glandulosa	1.25	0.25
Elymus glaucus	0.75	0.50
Galium angustifolium	0.75	0.75
Toxicodendron diversilobum	0.75	0.50
Yucca whipplei	0.50	0.25
Dryopteris arguta	0.25	0.25
Osmorhiza brachypoda	0.25	0.25
Achillea millefolium lanulosum	tr.	0.25
Brodiaea sp.	tr.	0.25
Claytonia perfoliata	tr.	0.25
Galium aparine	tr.	0.25
Heteromeles arbutifolia	tr.	0.25
Lilium parryi	tr.	0.25
Salix sp.	tr.	0.25
Salvia apiana	tr.	0.25
Sanicula graveolens	tr.	0.25
Solidago californica	tr.	0.25
Thalictrum fendleri	tr.	0.25
Vicia americana	tr.	0.25

small clumps of Engelmann and coast live oaks growing in savanna-like situations (photo 18). These "mini-savannas" are typically made up of only a few trees, growing in deep Fallbrook soils, but are indicative of soil-moisure conditions similar to the well-developed Engelmann oak savanna at Organ Valley RNA (Burke 1985).

White Alder Riparian Forest (61510): This forest forms an intermittent cover surrounding the small stretches of permanent moisture along the main and west forks of King Creek (photo 19). It is dominated by white alder, which may reach diameters of 24 inches (61 cm) and heights of 60 ft. (18.2 m). Also occurring are scattered individuals of California sycamore, and the willows *Salix laevigata* and *S. lasiolepis*. A number of hydrophilic understory species occur and include: *Lilium parryi, L. pardalinum, Rosa californica, Carex spissa, Potentilla glandulosa, Erigeron philadelphicus, Mentha spicata, Aquilegia formosa, Thalictrum fendleri,* and *Woodwardia fimbriata*.

Freshwater Seep (45400): This community is restricted to one major springy area in the SE 1/4 Sec 24 T14S, R 3E. This seep is a relatively flat, marshy site approximately 1 acre (0.4 ha) in area. It may represent the base of an ancient slope failure and is associated with a relatively large dry meadow immediately below. The vegetation is dominated by tall rank herbaceous species and includes *Carex spissa, Cyperus parishii, Typha latifolia, Oenothera elata* ssp. *hirsitissima*, *Hypericum formosus* ssp. *scouleri, Lotus oblongifolius, Lythrum californicum,* and *Solidago confinis*. Surrounding vegetation is a transitional oak woodland with canyon live oak, coast live oak, and scrub oak as dominants (photo 20).

FAUNA

Appendix 2 lists all vertebrates noted from the RNA during the ecological survey. This includes 66 species. Of these, several are listed by the State Department of Fish and Game as species of special concern. The following accounts briefly describe these species' status in the area.

Golden Eagle: This majestic bird was seen twice in three days in the RNA, both times soaring over the upper slopes of Cuyamaca Peak. It is a likely nester in the vicinity of the RNA and probably regularly hunts for mammals within the RNA.

Cooper's Hawk: This crow-sized hawk specializes in capturing birds. It was seen once soaring over the lower part of cypress station #3. It is a likely nester in the vicinity of the RNA.

San Diego Horned Lizard: This is an endemic southern California subspecies of the coast horned lizard. It was seen once in three days in the mafic chaparral adjacent to a cypress stand at about 4600 ft. (1402 m) elevation. The individual was a full sized adult and was mottled with rich reddish brown blending in well with the surrounding reddish gabbroic rocks and soil (see photo 4). It was seen adjacent to a trail of small carpenter ants, which it may have been feeding on.

San Diego Mountain Kingsnake: This is an endemic subspecies of the widespread mountain kingsnake, restricted to the mountains of San Diego County. One approximately 2.5 ft. (76 cm) long individual was seen in a thicket of *Rosa californica* and *Symphoricarpos mollis* adjacent to the dry creek bed of the West Fork of King Creek. It was found on a warm day that followed three days of rain.

In general, the fauna of the King Creek area is composed of species typical of the chaparral and oak woodlands of Cismontane southern California. Several chaparral birds such as black-chinned sparrow, wrentit, Bell's (sage) sparrow, and California thrasher are common and conspicuous. Oak woodland species such as scrub jay, Hutton's vireo, and acorn woodpecker occur in the coast live oak forests. The presence of Townsend's solitaire and olive-sided flycatcher (both likely breeders at this time of year) at the summit grove of Coulter pines indicates some representation of a montane coniferous forest element to the fauna.

Several species of mammal were seen or their sign noted. The most abundant species in the coast live oak forest appears to be the dusky-footed woodrat, which has a high density of houses (1 / 100-150 sq. m) and well developed runways developed in dense understory vegetation. Several species of carnivores were noted by their tracks or scat including coyote, bobcat, gray fox, and possibly mountain lion. Deer sign was also seen regularly throughout.

GEOLOGY

Cuyamaca Peak lies on the crest of the Peninsular Ranges. This range is composed of a series of steep mountain ranges made up of primarily granitic rocks of the Southern California Batholith with a mixture of older schists and gneisses.

Two principal rock types occur in the RNA. These are the Bonsal Tonalite (a granitic rock) and the Cuyamaca gabbro (Everhardt 1951). The gabbro underlies the majority of the RNA including all of the upper elevations above 4600 ft. (1402 m) The tonalite outcrops along the southern side of the RNA. Both rock types are part of the southern California Batholith and are thought to have been emplaced in the Upper Cretaceous, 115-120 million years ago (Norris 1976).

The Cuyamaca gabbro is the older of the two crystalline rocks and typically weathers with fewer outcrops. Only small outcrops of gabbro occur on the northern and northwestern ridges of the RNA, while in contrast, large outcrops of the Bonsal Tonalite occur just to the east of the RNA on the slopes of Japacha Peak and smaller slabs of tonalite occur on the ridge bounding the western side of the West Fork of King Creek drainage.

SOILS

The soil survey for San Diego County (U.S.D.A. 1973) describes four soil series occurring within the boundaries of the KCRNA. Two are derived from gabbro and two from granitic rock (all series and mapping units are depicted on Map 4). The most extensive is the Las Posas, represented locally by the Las Posas stony fine loam 30-65% slopes, and on more gentle exposures the Las Posas stony fine sandy loam 9-30% slopes. Most of the cypress stands occur on this soil, as does the southern mafic mixed chaparral. This soil is a well-drained moderately deep, stony fine sandy loam that has a clay subsoil. It is a reddish brown to dark brown soil in the A horizon, but ranges from reddish brown to red in the B horizon. Depth to bedrock is 26-40 inches (66-102 cm). Permiability is moderately slow in the subsoil layers, and the water holding capacity is 4 to 6 inches (10-15 cm) due to the subsurface clay. The erodibility of this type of soil is very high due to the steep slopes and rapid runoff. The soil is slightly alkaline (pH 7.3) at the surface and slightly acid (pH 6.5) at the subsoil/bedrock interface.

The Boomer stony loam occurs along the upper slopes of the RNA and underlies the highest stand of cypress (mostly outside of the RNA) as well as the canyon live oak forest and most of the upper elevation Coulter pine forest. It is also a well drained moderately deep stony loam, derived from gabbro, that has a stony clay loam subsoil. The subsoil, permeability, soil water holding capacity, and erodibility factors are all similar to the Las Posas soil, however, the pH ranges from 6.5 at the soil surface to 5.8 at the subsoil/bedrock interface. The vegetation on Boomer soils is notably stunted and widely spaced compared to vegetaion on the Las Posas soils. This may be the result of shallower and harsher soil conditions. Two mapping units of Boomer soils occur, the Boomer stony loam 30-65% slopes, and the Boomer stony loam 9-30% slopes. The latter unit occupies the gentle saddle area between 5600 and 5800 ft. (1707-1768 m) at the northeast corner of the RNA.

The Cieneba soil series occupies the soils derived from Bonsal Tonalite in the southern part of the RNA. It has been divided into two mapping units (USDA 1973), both about equally represented in the RNA. The first of these is the Cieneba coarse sandy loam 15-30% slopes. These soils are from 10-20 inches (25-51 cm) deep and are brown to grayish brown. Fertility is low. Permiability is rapid. Available water holding capacity is 1-2 inches (2.5-5.1 cm). Runoff is medium to rapid, and the erosion hazard is moderate to high. The second unit is the Cieneba very rocky coarse sandy loam 30-75% slopes. In contrast with the previous type this soil is steep to very steep, has rock outcrops on about 20% of the surface and very large granitic boulders on about 30% of the surface. It is only 5 to 15 inches (13-38 cm) deep over hard granitic rock. Runoff is rapid to very rapid, and the erosion hazard is high to very high. The available water holding capacity is 1-1.5 inches (2.5-3.8 cm).

A small area at the lowest part of the West Fork drainage is classified as Fallbrook rocky sandy loam 9-30% slopes. This soil is also derived from granitic rock. It differs from the Cieneba series primarily in its greater depth (20-34 inches, 51-86 cm). Large boulders cover 10-25% of the surface and rock outcrops 10%. Natural fertility is low, water holding capacity is 3-5 inches (7.6-12.7 cm). Runoff is medium rapid and erosion is moderate to high.

The final soil classification for the RNA is rock outcrop. This consists of

extensive slopes of Bonsal Tonolite on the previously mentioned western side of the lower West Fork drainage.

CULTURAL VALUES

The area that is presently considered the King Creek RNA was once part of the Tipai tribal territory (Luomala 1978). There was a distinct vertical annual cycle to bands of Tipai. Because of the relatively high elevation of the RNA the area was probably used only in the warmer months of the year. Dorthy Hall, Cleveland National Forest Archaeologist (personal communication, November 1990) suggests that a better name for the local tribe would be Diegueno or Kumeyaay. No cultural sites are indicated for the RNA on the archaeological atlas for the area. However, several sites are known from near the Burney Ranch just west of the RNA. Acorns, deer, rodents, and birds were probably occasionally hunted in the RNA.

AQUATIC VALUES

The majority of the West Fork and the main fork of King Creek are dry most of the year. However, these two main stream channels have small springs associated with them within the RNA boundaries. Perennial springs occur on the unnamed west branch of the West Fork of King Creek (NE1/4 Sec 25 T14S, R3E, as well as on the West Fork in several places over about 1 mile in length stretching from the SE 1/4 Sec. 19 T14S, R3E to the NE1/4 SE 1/4 sec 25 T 14S R3E. The main spring along the West Fork has a flow of about 1.85 gallons (7 liters) per minute during the later months of the summer (Reveal 1978).

No detailed survey was made of the aquatic resources of the area. However, several species of aquatic invertebrates (water-striders, caddisflies, small Diptera larvae, among others) were noted along the flowing parts of the West Fork. Pacific treefrogs were heard calling along wooded flowing stretches of this stream.

IMPACTS AND POSSIBLE CONFLICTS

Grazing:

The area including the KCRNA is part of an inactive grazing allotment known as the Hulbard Range Allotment. According to the District Ranger E. Nelson Dean of the Descanso Ranger District, should there be renewed interest in this allotment in the future, the allotment boundaries will be adjusted to exclude grazing from the RNA.

Currently (1990) there is no evidence of recent grazing activities in the area. However, the lowermost meadows, adjacent to the private land in section 36 T 14S, R3E SBBM show some disturbance. This disturbance is manifested by open soil with a sparse cover of introduced grasses and annual forbs, and a few small erosion gullies. Some of this disturbance was a result of past over-grazing and some erosion as a result of trail and jeep road travel and constuction in the area. The erosion gullies appear to be associated with the trail that parallels the West Fork. The deepest gullies cut about 18 inches (46 cm) into the granitic Fallbrook soil.

Recreation:

The KCRNA is not heavily used recreationally. The strongest evidence of use is from OHVs driving the power line road along the northern boundary. This road and its several spurs have been regularly used by four-wheel drive vehicles, probably largely during deer-hunting season in the fall. Several campfire rings occur adjacent to the power line road in the flat areas along the ridge crest at 4350 ft. (1326 m) and again at the upper saddle at about 5700 ft. (1737 m). Litter (beer bottles, aluminum cans, and tin cans) is sporadic along this road.

The road itself has been severely eroded in some places, particularly the very steep pitches in the NW 1/4 sec. 24 T14S, R3E, near the junction with the Boulder Creek road. The worst parts of the road are virtually impassible even to the most daring drivers. However, one approach is still driveable. This approach has been signed with a no OHV use sign at its junction with the Boulder Creek Road (at approximately 3720 ft., 1134 m, SW 1/4 NW 1/4 sec. 24 T14S, R3E). However, use continues as indicated by recent tire tracks well up on the ridge. Use, especially during the wet part of the year, may result in large increases in erosion.

Despite the ease of access afforded by the road on private land, approaching

to within a few feet of the southern boundary, recreational use in this area appears light. Many years ago the main spring on the West Fork was tapped with a 6 inch (15 cm) pipe, and water was piped on the surface down to the private land approximately 1 mile (1.6 km) below the spring. This pipe has been disconnected. At present, most of it still remains on the surface. The small cement and rock diversion dam and cistern along the creek also remain. A gate in the three strand barbed wire fence at the edge of the private land (SW 1/4, SE 1/4 Sec. 25 T14S, R3E) indicates that at one time vehicles could drive up the trail along the West Fork. However, no vehicle has used this route for many years.

The fire trails built by bulldozer during the fighting of the 1950 Conejos fire are still apparent in many of the areas of mafic mixed chaparral (Map 2). However, in other vegetation types such as scrub oak chaparral and coast live oak forest are reverting back to their previous vegetative cover, often with little evidence of disturbance remaining. These trails are important access routes for researchers studying the cypresses and other vegetation in the RNA interior.

Additional fire trails were build in 1970 to help contain the Boulder Fire. These are limited to the northern boundary and include the previously mentioned powerline road. Unfortunately, this route has a proliferation of bulldozed tracks associated with it. Map 2 shows some of these. In particular, note the two roughly parallel routes along the northern boundary. The northernmost follows the actual power line route, and the other is the wider, better graded one. It seems reasonable to maintain one of these, but not both for fire management in the cypress stands.

MANAGEMENT CONCERNS

Of foremost concern is proper management of the Cuyamaca cypress population. Information on this and related species in similar vegetational surroundings indicates that protection from fire for a number of years is necessary to insure build up of sufficient seed supply to sustain the population (Scheid and Zedler 1989). The 1950 Conejos Fire burned the majority of the population. Then again in 1970, the Boulder fire burned the upper portion of the population (stands 3a and 3b, see map 5). Scheid and Zedler recommend that fire be excluded from the area burned in 1970 for at least another 20 years, while the area burned most recently in 1950 could

sustain a fire at present without adverse effects to the population.

Optimum fire frequency for Cuyamaca cypress is estimated between 50 and 100 years. Scheid and Zedler strongly suggest an active fire suppression policy for the next 20 years until the younger portion of the population reaches reproductive maturity.

Scheid and Zedler have discussed other methods of artificially increasing the population of Cuyamaca cypress, including thinning of competing shrubs and planting of seedlings. However, they suggest that the most economically efficient, the least risky, and the most natural method of insuring the viability of the population is to simply exclude fire from the area until seed banks have increased in the 1970 cohort.

Although the most threatened (youngest) portion of the population is almost entirely on State Park Land, access to it is through Forest Service land (see map 5). The importance of maintaining the existing network of fire trails and roads in the RNA is stressed by Scheid and Zedler. These trails will provide access to the cypress population in the event of a fire, and could conceivably protect the trees from burning when young. Although, road maintance is in conflict with most RNA values, the principal objective of maintaining the population of Cuyamaca cypress overrides the natural unroaded condition most RNAs are mandated to support. The methods of fire trail maintanence will be addressed in the management plan. However, as a concession to the highly erosive soils, its seems advisable to affect this maintanence by manual brushing-out the vegetation, rather than by periodic clearing by bulldozer.

A program of active fire suppression for the next 20 years will not adversely affect the remaining vegetation in the RNA. There is now good evidence that natural fire frequencies in chaparral may be much lower than once thought (Keeley and Keeley 1988). Local evidence, based upon the vigor of chamise and other shrubs following over 80 years without fire, suggests that many of the dominant chaparral species can survive very long fire intervals[3].

BOUNDARY CHANGES

The original boundary as described in a letter by E. Nelson Dean, Descanso

[3] It is believed that the chaparral surrounding cypress station 2a is over 80 years old (Scheid and Zedler 1989).

District Ranger (May 1988) indicates a different northwestern boundary than is shown in map 2. Originally, this boundary was said to follow the power line road (see map 6). Justifications for altering the boundary as indicated in map 2 of this report may be made on logistical and ecological grounds.

The power line road is ill-defined, actually consisting of two or more parallel routes ascending the the ridge which marks the southwest shoulder of Cuyamaca Peak. In several places there are three roughly parallel tracks and it is difficult to define a boundary based on the description of these roads. The power line itself will not be a permanent fixture in the area. According to Tom White (Cleveland National Forest RNA coordinator) it is scheduled to be dismantled, further complicating the definition of the original northwestern boundary.

In addition to these logistical arguments, the establishment of a RNA boundary based on a prominent topographic feature is more advisable than on a relatively evanescent human boundary. A case in point is that several individuals of Cuyamaca cypress grow to the west of the main powerline road in the NW 1/4 sec. 19 T14S, R4E. Potentially these individuals could act as important seed sources for the future extension of stand 3a to the west of the powerline road (see map 5).

Conflicts as a result of incorporating portions of the powerline road network into the KCRNA are relatively minor. Exclusion of off-highway vehicles would be pursued to insure the pristine conditions of the boundary area. Use of these roads by fire crews during any fire affecting the Cuyamaca cypress population is the next 20 years is likely. However, as the population is not limited to the northwestern boundary it may prove necessary to construct additional fire lines around lower elevation stands, thus affecting the RNA whether defined by either set of boundaries.

RECOMMENDATIONS

I strongly recommend the establishment of the KCRNA. The Cuyamaca cypress values cannot be duplicated elsewhere . Although a small portion of the population occurs on adjacent State Park land this includes only about 30% of the total area of cypress. Any preservation-oriented management of the cypress stands on State Park land would be crippled without cooperation by the Forest Service. Hence, joint management is essential.

The designation of the KCRNA will achieve the best protection for the

Cuyamaca cypress for two main reasons: 1) the majority of the population exists on Forest Service Land, 2) the RNA can be managed as a discrete area for the primary purpose of maintaining the cypress population. This means that recreational use, which may bring accidental fire, seed and plant collectors, and other undesirable features would be held to a minimum. RNA designation would also insure a fire management policy designed specifically for the protection of the cypress, without the broader management concerns facing other designations such as wilderness or multiple use lands.

The additional values of the several other rare plant and animal species, the disjunct species, the gabbro endemism, and the well-developed riparian and meadow habitats in the area strengthen the case for the establishment of this unique area as an RNA. Based on arguments presented above, I believe the best boundary for the northwestern portion of the area is the actual ridgetop descending the southwest flank of Cuyamaca Peak.

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APPENDICES

Appendix 1
List of Vascular Plants Noted for King Creek RNA

This list is based on the taxonomy of Beauchamp (1986). It includes all species identified from the RNA during field work for the Ecological Survey conducted from April 17 through April 20, 1990. The list also includes a few species previously collected from the area, but nor seen during the field work. Total number of taxa in the list is 204. Question marks following a species name indicates uncertain identification, largely as a result of the absence of reproductive organs. Abbreviations for plant associations are defined below.

CC.....Cuyamaca Cypress
CO.....Canyon oak
CLO.....Coast live oak
CP.....Coulter pine
SS.....Diegan sage scrub
MC.....Mafic southern mixed chaparral
SO.....Scrub oak chaparral
WA.....White alder riparian forest

Acer macrophyllum : occasional WA and CLO along W. Fork.
Achillea millefolium var. *lanulosum* : occasional semi shade of CLO also in meadows.
Adenostoma fasciculatum : co-dominant of MC and also in CC and occasional at edges of other associations suvh as CLO and SS.
Allium campanulatum : locally common in heavy soils in MC
Alnus rhombifolia : common along flowing parts of W. Fork (WA).
Aquilegia formosa var. *truncata* : occasional WA.
Arctostaphylos glandulosa ssp. *glandulosa* : co-dominant of the MC. also in rocky CC stands.
Arctostaphylos pungens : occasional lower elev. along W. Fork, edge CLO
Artemisia douglasiana : WA, seep
Artemisia ludoviciana : occasional in meadows, mid and lower elevs.
Asclepias californica : rare in meadow along lower W. Fork.
Asclepias fascicularis : uncommon, upper meadow ca. 4600 ft.
Baccharis glutinosa : uncommon, lower W. Fork WA
Baccharis sarothroides : rare along trail lower W. Fork.
Brodiaea orcuttii : meadows along lower W. Fork.
Bromus breviaristus : common in largest of the meadows ca. 4700 ft.
Bromus diandrus : lower meadows.

Bromus mollis : common lower meadows
Bromus rubens : meadows, SS lower elevs.
Bromus sp.: perennial in lower meadow, may be *breviaristatus* or another
Bromus tectorum : occasional, meadows.
Calamagrostis densa : common, MC, throughout
Calandrinia ciliata var. *menziesii* : occasional, meadows.
Calocedrus decurrens : occasional along CLO W. Fork, also as saplings in CO, CP at upper elvations above 5700 ft.
Calochortus sp.: not in flower, most in MC are probably *C. dunnii* (known from RNA), but some at upper elevs. may be *invenustus* .
Calyptridium monandrum : rare SS, meadow openings, lower elvs.
Calystegia occidentalis ssp. *fulcrata* : occasional in MC, common at highest elevations in CO, CP
Camissonia sp. : lower meadow edge.
Camissonia confusa : meadows along lower W. Fork.
Camissonia strigulosa : fairly common, lower meadows.
Carex globosa : rock outcrops ridges 4600-5800 ft.
Carex spissa : common in seep and WA, not reported above 900 m by Beauchamp (1986)
Castilleja martinii : upper sloes near saddle at 5600-5700 ft. CO. CP just coming into flower.
Castilleja miniata : small ravine ca 4700 ft. CO-MC ecotone
Ceanothus foliosus : occasional in MC common as at 5600 ft. saddle, low, blue flowered, single-nerve leaves.
Ceanothus greggii ssp. *perplexans* : common in MC, also in SO
Ceanothus leucodermis : fairly common in SO and edges of CLO
Ceanothus oliganthus : fairly common in MC, dark blue flowers,3- nerved leaves
Ceanothus palmeri : primarily in upper elevation chaparral and CO
Cercocarpus betuloides : occasional SO or ravine bottoms in MC
Chaenactis sp.: basal leaves in SS, W . Fork
Cheilanthes covillei : occasional in ridge top rocks 4200-5600 ft.
Cirsium californicum : occasional SS, W. Fork.
Clarkia sp. #1: *C. purpurea* or *C. rhomboidea* types pre-flowering, purple leaf veination, in edges of SS and Meadows, lower elvs.
Clarkia sp. #2: narrower leaves than previous w/out purple leaf veins.
Claytonia perfoliata : occasional CLO
Clematis lasiantha : occasional lower elv. MC and SO, W. side of RNA.
Clematis ligusticifolia : WA along W. Fork.
Cordylanthus filifolius : common SS meadow edge, trails, and other openings.
Corethrogyne filiginifolia var. *glomerata* : edge of meadows, SS, lower

elev., occas up to 5600 ft.

Crassula connata : local in some meadows, lower W. Fork. above listed elev. in Beauchamp.

Cupressus arizonica ssp. *stephensonii* : locally common and dominant in CC ca 4200-5600 ft. also scattered in CLO and WA along W. Fork.

Cyperus parishii : occasional WA and seep

Datisca glomerata : occasional WA along W. Fork.

Dichelostemma pulchellum : common in meadows and ocasional in MC mid and lower elevs.

Diplacus aurantiacus ssp. *australis* : occasional rocky exposures on W side.

Diplacus clevlandii : occasional rocky xeric exposures in MC at lower elevations.

Dryopteris arguta : occasional CLO

Dudleya abramsii : rare high elev outcrops, 5800 ft.

Dudleya pulverulenta : rocks along stream, meadow edges, SS

Eleocharis montividensis var. *parishii* : seep

Elymus glaucus : occasional CLO.

Equisetum hymale ssp. *affine* : occasional WA.

Erigeron foliosus : occasional CP mid elevations.

Erigeron philidelphicus : occasional WA along W Fork.

Ericameria arborescens ssp. *parishii* : open disturbed areas such as the summit saddle at 56-5700 ft. also occasional along power line road at edge of MC, CP, etc.

Eriogonum fasciculatum ssp. *polifolium* : SS and meadow edges, lower elev.

Eriophyllum confertiflorum : occasional lower elev. MC, more comon high elev. CO, CP

Erodium botrys : common in meadows, W. Fork.

Erodium cicutarium : common in Meadows.

Euphorbia palmeri : high elev outcrops 5800 ft.

Euphorbia sp.: annual, edge of seep and upper meadow

Fagaria californica : CLO understory, local.

Galium andrewsii : occasional mid and upper elevations under CO, CP.

Galium angustifolium : fairly common CLO, SO

Galium aparine : occasional shade of CLO

Garrya flavescens ssp. *flavescens* : occasional in lower MC, ca. 4200 ft.

Garrya fremontii : locally common in upper saddle 56-5700 ft CO, CP, S limits here?

Gilia australis :. uncommon, open meadow, big upper meadow

Gilia capitata ssp. *abrontanifolia* : common in lower meadows.

Gnaphalium microcephalum ?: rare at highest elevations CO, CP
Gutierrezia californica : common SS, M, fire roads,
Habenaria elegans : regular in CC, also CP
Hazardia squarrosus ssp. *grindelioides* : occasional in more open MC and along fire trails.
Helianthemum scoparium var. *aldersonii* : fairly common along powerline rd., esp. lower elevations
Helianthus gracilentus : common on powerline roads, and other openings
Hemizonia fasciculata : at large upper meadow ca. 4600 ft. nor reported above 900 m by Beauchamp.
Heteromeles arbutifolia : fairly common in MC and SO lower and mid elevs.
Hieracium albiflorum ; occasional highest elevations CP and CO
Hymenothrix wrightii : occasional in mid and lower meadows and SS
Hypericum formosus ssp. *scouleri* : seep in meadow.
Hypochoeris glabra : meadows along W. Fork.
Juncus effusus var. *pacificus* : seep
Juncus macrophyllus : occasional moist meadow and seep, W. Fork
Juncus mexicanus : seep
Keckiella ternata : occasional SO, CLO
Koeleria macrantha : meadows mid and lower W. Fork.
Lasthenia californica : occasional large lower mendow.
Lathyrus laetiflorus ssp. *alefeldii* : uncommon in lower W Fork drainage CLO, SO
Layia sp.: (probably *L. platyglossa*) not in flower in lower and mid meadows of W. Fork.
Lepidium nitidum : common in mid and lower W. Fork meadows.
Lilium humboldtii var. *bloomerianum* : fairly common at upper elevations in CO and CP ca 5000-5700 ft.
Lilium pardalinum : rare along W. Fork near diversion dam, WA
Lilium parryi : occasional along moist to wet creekbed, WA, CLO W. Fork.
Linanthus androsaceus ?: in bud only, common in lower meadow.
Linanthus dianthiflorus : common and showy in lower meadows.
Lomatium dasycarpum : common lower to mid- elev. MC, CLO edge, SS, fire roads , etc.
Lonicera subspicata ssp. *johnstonii* : occasional CO, CLO
Lotus crassifolius : common at saddle ca. 5700 ft. CO, CP
Lotus oblongifolius : seep
Lotus scoparius ssp. *brevialatus* : lower elevations in W. Fork drainage.
Lotus sp.: annual species fairly common in dry meadows of W. Fork.
Lupinus concinnus ssp. *optatus* : occasional low elev meadows.

Lupinus excubitus ssp. *austromontanus* : highest elevations CO, CP, also lower SS-M border
Lupinus sp.: annual, sparsely strigose small leaves, lower meadows.
Lythrum californicum : marshy seep.
Madia sp.: foliage only meadow-CLO edge.
Mahonia dictyota : SO, CO, CLO, semi-shade
Marah macrocarpus : occasional in MC, CLO
Medicago polymorpha : fairly common lower elevation meadows.
Melica imperfecta : uncommon in CLO, CP and SO
Mimulus sp.: basal leaves in seep in seep, probably M. guttatus.
Mentha spicata : farily common along WA on W. Fork.
Monardella sp.: low spreading either *macrantha* or *nana* ; among rock outcrops on ridges and CO, CP 4200-5800 ft. not in flower.
Muhlenbergia rigens : common in lower meadows, to ca. 5200 ft. in openings in CO.
Oenothera californica ?: basal leaves, sandy areas in lower meadows of W. Fork.
Oenothera elata ssp. *hirsuitissima* : marshy seep
Opuntia littoralis var. *vaseyi* : uncommon around granitic rocks in lower meadows and slopes.
Orthocarpus purpurascens : common lower meadows, just coming into flower.
Osmorhiza brachypoda : occasional CLO.
Paeonia californica : rare, edge of lower meadow near private land.
Pectocarya linearis ssp. *ferrocula* : rare at lowest elev. meadow
Pellaea andromedifolia : occasional SO, CLO
Pellaea mucronata : occasional, xeric MC
Penstemon centranthifolius : occasional SS lower W. Fork.
Penstemon heterophyllus : occasional openigns in MC and SS
Phacelia imbricata ssp. *patula* : uncommon rock outcrops adjacent to large upper mendow.
Phlox austromontana : high elevation saddle ca. 5600-5800 ft.
Phoradendron villosum : on scrub oak, W Fork.
Pickeringia montana ssp. *tomentosa* : rare, edge of powerline road ca. 4400 ft. CP, MC.
Pinus coulteri : scattered from CLO along lower W. Fork to highest parts of RNA, CP, CLO, CC
Pinus lambertiana : occasional as saplings in CO, CP above 5600 ft.
Plagiobothrys californicus var. *fulvescens* : fairly common edges of trails, meadows, lower elevs.
Plagiobothrys tenellus : occas. in lower meadows.

Plantago erecta: very common in lower meadows, not cited from above 300 m in Beauchamp.

Platanus racemosa: fairly common WA, W. Fork.

Poaceae sp: *Melica* hybrid?, 3-4 florets, minute awn from toothed lemma tip, rare in rocks at mid-elev.

Polystichum imbricans ssp. *imbricans*: high elev. outcrops ca. 5800 ft.

Potentilla glandulosa ssp. *glandulosa*: fairly common shade of CLO and WA.

Pteridium aquilinum var. *pubescens*: upper elvations CO, CP. also occasionally in CLO, along W. Fork.

Quercus chrysolepis: common in upper elevations above 4600 ft. major component of CO and CP up to highest elevations.

Quercus dumosa: common dominant of mesic SO low to mid elevations

Quercus dumosa x Q. engelmannii: scattered in SO chaparral and ravine edges lower to mid elevations (below 4200 ft)

Quercus engelmannii: scattered in CLO, ans as borders of meadows, lower W. Fork, most common on shallow soils of SW-facing granitic slopes, lower W. Fork.

Quercus kelloggii: occasional in mesic CLO along upper W. Fork, more common as shrubby resprouts at high elevs. 5600-5800 ft.

Quercus wislizenii var. *fructescens*: best represented as shrubby resprouts mid- elevations ca. 4700-5200 ft. adjacent to SO and CO

Quercus wislizenii x kelloggii (*Q.* X *morehus*): edge of upper meadow ca 4700 ft.

Rhamnus californica ssp. *tomentella*: common upper elevations in CP, CO, less common in CLO along W. Fork.

Rhamnus crocea: occasional in MC and SO lower to mid elevations.

Rhamnus ilicifolia: fairly common in MC up to ca. 5200 ft.

Rhus ovata: scattered in SO, MC lower elevations up to 4800 ft.

Rhus trilobata: occasional MC, SO, and CLO

Ribes indecorum: uncommon: edge CLO-SO

Rosa californica: common WA, CLO

Salix laevigata: most common willow in WA

Salix lasiolepis: WA, occasional

Salvia apiana: common SS and edges of MC up to 5200 ft.

Salvia clevelandii: occasional xeric MC low to mid elevations.

Salvia sonomensis: common MC, SO, CO, CP

Sambucus caerulea: uncommon edge of CLO along W. Fork.

Sanicula bipinnatifida: common in meadows, lower elevs.

Sanicula graveolens: occasional CLO

Sanicula tuberosa : local patches in MC

Selaginella bigelovii : around bases of granitic rocks at lower end of W. Fork drainage.

Senecio vulgaris : occasional in lower meadow along W. Fork.

Sidalcea malviflora ssp. *sparsiflora* : common in meadows and SS

Sisyrinchium bellum : common and dominant in some meadows.

Sitanion hystrix : occasional upper elvs. in openings in CO, fairly common in meadows, W. Fork

Solidago californica : occasional CO, CP upper elevations to lower elvs. in CLO.

Solidago confinis : wet seep above large upper meadow

Sonchus asper : rare, large meadow

Stachys rigida ssp. *rigida* : WA, seep, common

Stipa sp.: common in lower meadows of W. Fork. may be *S. lepida* , not in flower.

Swertia parryi : scattered in MC mid elevs.

Symphoricarpos mollis : dominant understory shrub in CLO

Symphoricarpos parishii ?: probably this taxon at highest portion of RNA on rocks in CO, CP.

Taraxacum officinale : seep, uncommon.

Tauschia arguta : occasional lower elev. MC on W side of RNA

Tauschia parryi : occasional, upper elvations in CO, CP 5500-5800 ft.

Thalictrum fendleri : occasional WA along W. Fork.

Toxicodendron diversilobum : common in CLO also occasional in SO, CP up to 4600 ft.

Trichostema parishii : scattered in the MC throughout.

Trifolium depauperatum var. *truncatum* : fairly common in meadows of W. Fork draiange.

Typha latifolia : seep in big upper meadow.

Vicia americana : occasional CLO and SO

Viola lobata var. *intrigifolia* ; CP knoll

Viola lobata var. *lobata* : 5600-5800 ft. saddle also in CP at 4300 ft.

Viola purpurea : shade and edges of CLO, SO

Vulpia myuros : occasional, lower meadows

Woodwardia fimbriata : WA, seep, occasional

Wyethia ovata : openings 4200-5700 ft. ridges

Yucca schidigera : occasional lower elvations W side of RNA

Yucca whipplei ssp. *whipplei* : common MC, SS throughout

Zauschneria canum ssp. *latifolium* : occas. rocky areas higher elevs. also rocks around big upper meadow.

Appendix 2
Vertebrates Known From the King Creek RNA

This list is limited to species identified from the RNA during the field work for the Ecological Survey April 17-20, 1990. Habitat abbreviations are the same as for the plant list (Appendix 1).

Reptiles and Amphibians[4]:

Pacific Tree Frog (*Hyla regilla*): heard along flowing portions of W. Fork
Western Fence Lizard (*Sceloporus occidentalis*): occasional in MC and on oaks adjacent to meadows.
Side-blotched Lizard (*Uta stansburiana*): uncommon in MC and meadows with granitic bounders.
San Diego Coast Horned Lizard (*Phrynosoma coronatum blainvillei*) : rare in MC and CC mid-elevations.
San Diego Mountain Kingsnake (*Lampropeltis zonata pulchra*): rare CLO.

Birds[5]:

Mountain Quail (*Oreortyx pictus*): fairly common, CLO, CO, CP, MC
Cooper's Hawk (*Accipiter cooperi*): seen over CC station three.
Red-tailed Hawk (*Buteo jamaicensis*): ocasional throughout
Golden Eagle (*Aquila chrysaetos*): sighted several times over upper elevations of RNA
Turkey Vulture (*Cathartes aura)* : occasional overhead.
American Kestrel (*Falco sparverius*): uncommon along N. boundary
Mourning Dove (*Zenaida macroura*): uncommon in MC
Band-tailed Pigeon (*Columba fasciata*): flocks in coast live oaks and Engelmann oaks at lower W. Fork.
Common Poorwill (*Phalaenoptilus nuttallii*): occasional, calling in evenings from MC.
Anna's Hummingbird (*Calypte anna*): occasional throughout
Black-chinned Hummingbird (*Archilochus alexandri*): occasional MC, SO
Acorn Woodpecker (*Melanerpes formicivorus*): occasional CLO, lower W. Fork
Northern Flicker (*Colaptes auratus*): fialry common in CP and CLO
Nuttall's Woodpecker (*Picoides nuttallii*): uncommon in CLO of lower W.

[4] reptile and amphibian taxonomy follows Stebbins, R. 1985. A field guide to western reptiles and amphibians. Houghton Mifflin, Boston

[5] taxonomy for birds follows Peterson, R.T. 1990. A field guide to Western birds, third edition. Houghton Mifflin, Boston.

Fork.

Ash-throated Flycatcher (*Myiarchus cinerascens*): uncommon MC, meadow edges, SO.

Western Wood Pewee (*Contopus sordidulus*): occasional: lower W. Fork in oaks.

Olive-sided Flycatcher (*Contopus borealis*): uncommon CP

Western Flycatcher (*Empidonax difficilis*): occasional CLO, SO

American Crow (*Corvus brachyrynchos*): uncommon flying over W. side RNA

Common Raven (*Corvus corax*): occasional overhead throughout

Scrub Jay (*Aphelocoma caerulescens*): common MC, SO, CP, CLO, CC throughout

Plain Titmouse (*Parus inornatus*): fairly common CLO, SO, CC.

Bushtit (*Psaltriparus minimus*): occasional in flocks at lower W. Fork in oaks and SO

House Wren (*Troglodytes aedon*): uncommon, CLO

Bewick's Wren (*Thryomanes bewickii*): fairly common in MC, SO, CLO.

Wrentit (*Chamaea fasciata*): fairly common MC, SO, CLO

Ruby-crowned Kinglet (*Regulus calendula*): uncommon transient in CLO

California Thrasher (*Toxistoma redivivum*): common MC, SO throughout.

Townsend's Solitaire (*Myadestes townsendi*): rare, summit saddle area in CO, CP

Hermit Thrush (*Cathartus guttatus*): migrant or winter resident in CLO and SO

Western Bluebird (*Sialia mexicana*): uncommon flying overhead.

Hutton's Vireo (*Vireo huttoni*): occasional CLO

Warbling Vireo (*Vireo gilvus*): transient? seen in SO and MC singing sub-songs.

Yellow-rumped (Audubon's) Warbler (*Dendroica coronata*): occasional migrant and winter resident throughout.

Hermit Warbler (*Dendroica occidentalis*): a few transient individuals seen in CLO, W. Fork.

Black-throated Gray Warbler (*Dendroica nigrescens*): several seen in SO, CLO, may breed here.

Nashville Warbler (*Vermivora ruficapilla)* : singing individuals in SO and CLO

MacGillivray's Warbler (*Oporornis tolmei*): transients seen in MC and SO, lower W. Fork drainage.

Orange-crowned Warbler (*Vermivora celata*): fairly common MC, SO, CLO.

Wilson's Warbler (*Wilsonia pusilla*): migrant fairly common during visit in several habitats

Red-winged Blackbird (*Aegelaius phoeniceus*): uncommon flying over W. side of RNA.

Northern (Bullock's) Oriole (*Icterus glabula bullocki*): locally common in oaks bordering meadows of lower W. Fork.

Sage Sparrow (*Amphispiza belli*): uncommon in MC at mid and lower elevations in W. Fork.
Black-chinned Sparrow (*Spizella atrogularis*): common MC
Fox Sparrow (*Passerella iliaca*): winter resident or transient in mid elevations
Song Sparrow (*Melospiza melodia*): rare, heard from W side of RNA in valley below Boulder Creek Rd.
Rufous-sided Towhee (*Pipilo erythrophthalmus*): common MC, CLO, CP, CO
California (Brown) Towhee (*Pipilo crissalis*): fairly common edge MC, SS, CLO
Black-headed Grosbeak (*Pheucticus melanocephalus*): fairly common CLO, SO
Lesser Goldfinch (*Carduelis psaltria*): common throughout.
Lawrence's Goldfinch (*Carduelis lawrencei*): uncommon, lower W. Fork drainage.

Mammals[6]:

Broad-footed Mole (*Scapanus latimanus*): occasional in CLO, SO, and meadows
Coyote (*Canus latrans*): scat and prints on fire trails.
Gray Fox (*Urocyon cinereoargenteus*): scat on trails
Mountain Lion (*Felis concolor*): tracks seen on powerline road, larger than bobcat with no claw marks.
Bobcat (*Lynx rufus*): fresh tracks seen on powerline road.
Mule Deer (*Odocoileus hemionus*): fresh tracks seen on fire trails throughout.
Merriams Chipmunk (*Tamais merriami*): uncommon in MC and CO
Botta Pocket Gopher (*Thomomus bottae*): common in meadows in W. Fork drainage
Dusky-footed Woodrat (*Neotoma fuscipes*): common (densities of middens up to 1/100 m^2) in CLO along W. Fork also in SO.
Brush Rabbit (*Sylvilagus bachmani*): occasional in meadows and SO, MC

[6]taxonomy for mammals follows Jameson, E.W., and H.J. Peeters. 1988. California Mammals. U.C. Press, Berkeley and Los Angeles.

APPENDIX 3
CLIMATIC INFORMATION FROM
CUYAMACA RANCHO STATE PARK HEADQUARTERS
(DATA FROM SCHEID AND ZEDLER 1989)

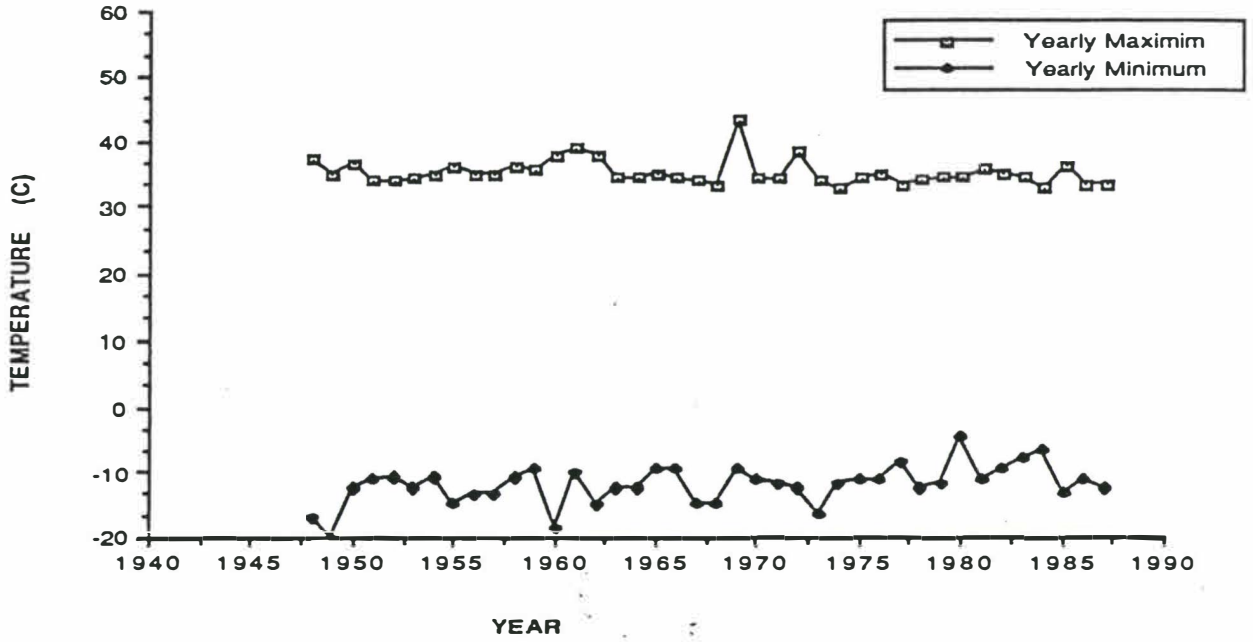


FIGURE 3. Yearly temperature profile for Cuyamaca Rancho State Park showing the extremes in temperature occurring in this region.

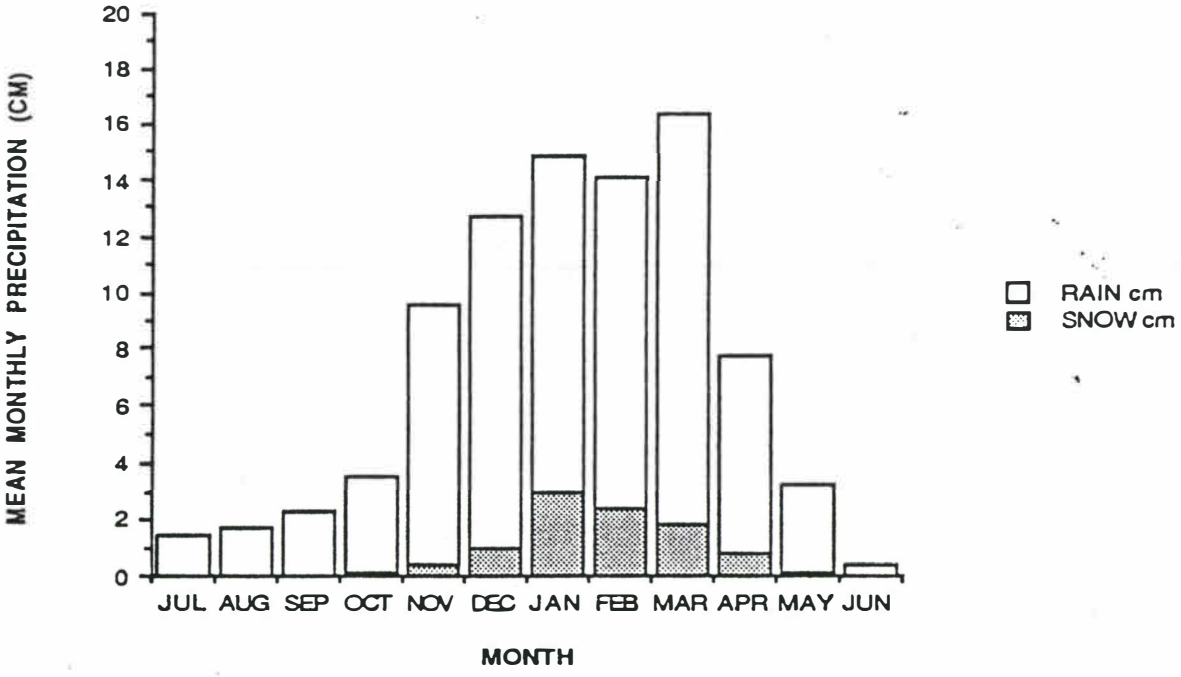
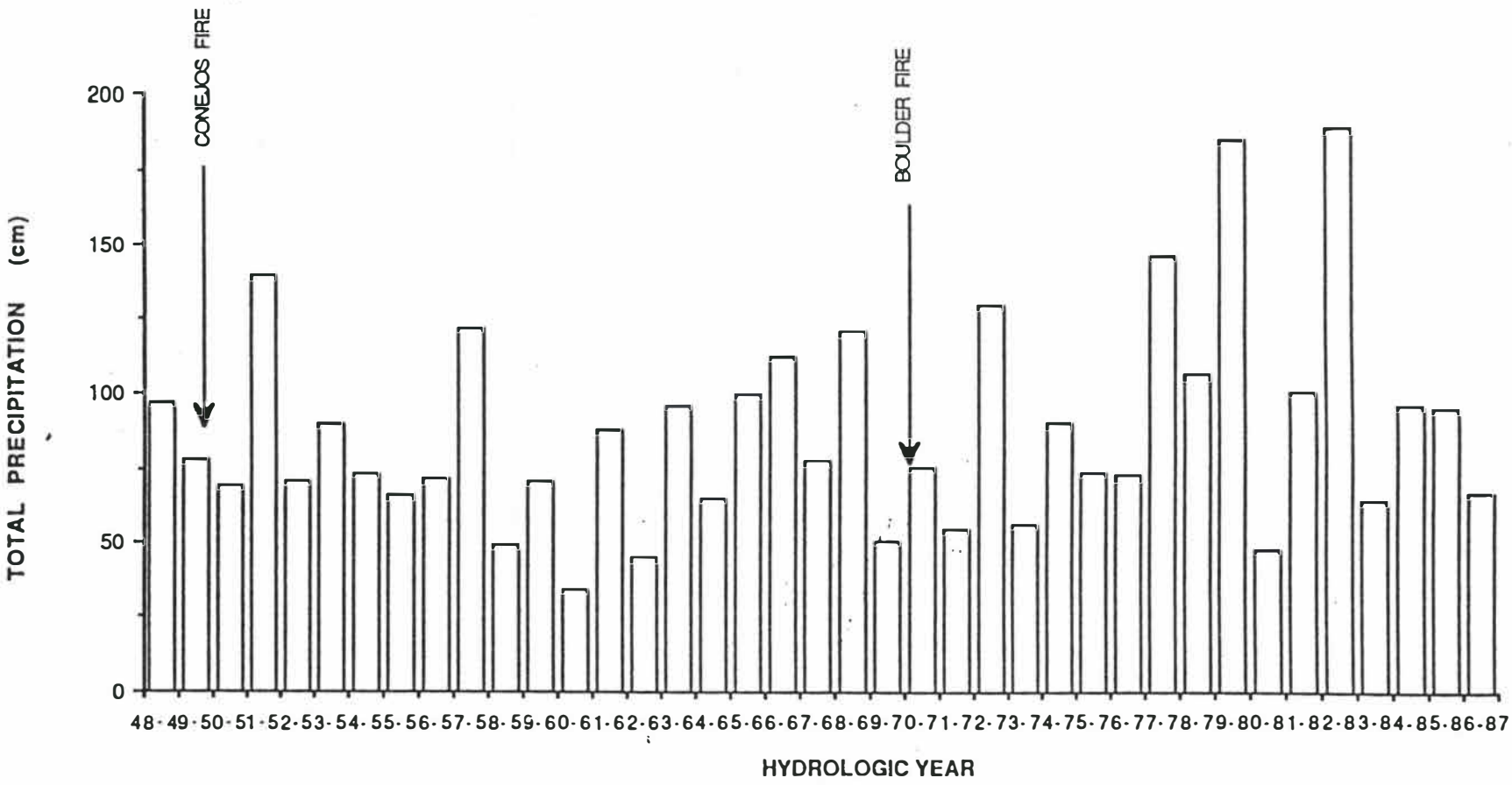


FIGURE 4. Monthly precipitation pattern for Cuyamaca Rancho State Park is dominated by heavy inputs from late fall through early spring. The elevation and the presence of summer rains help mediate the Mediterranean type climate of wet winters and dry summers characteristic of much of southern California.

FIGURE 5 (next page). Precipitation patterns for the Cuyamaca Rancho State Park area from 1948-1987. At least one year of below average precipitation preceded both the 1950 Conejos and the 1970 Boulder fires. The hydrologic year in San Diego County runs from July 1st of one year to June 30th of the next year.


CONEJOS FIRE
BOULDER FIRE
TOTAL PRECIPITATION (cm)
200
150
100
50
0
48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87
HYDROLOGIC YEAR

APPENDIX 4
VEGETATION SAMPLING DATA FOR ALL STANDS OF CUYAMACA CYPRESS ON PUBLIC LANDS
(DATA FROM SCHEID AND ZEDLER 1989)

Table 1. Percent live cover by species for stations containing cypress and adjacent areas without cypress (in parentheses). Station 2 cover values are the same between areas due to low density of trees at this site. Station 6 was not sampled for cover.

Transect lengths	stn 1 90 (50)	stn 2 100 (100)	stn 3a 150 (50)	stn 3b 250 (100)	stn 3c 120 (50)	stn 4 270 (100)	stn 5 80 (50)
Adenostoma fasciculatum	22.0 (70.1)	62.3 (62.3)	0.76 (1.4)	2.7 (34.5)	24.1 (40.7)	33.9 (53.5)	45.8 (64.3)
Arctostaphylos glandulosa	0.67 (----)	10.0 (10.0)	13.7 (5.6)	3.3 (27.8)	28.4 (23.9)	10.5 (10.6)	7.7 (10.1)
Calamagrostis densa	2.0 (----)	----- (----)	----- (----)	----- (----)	----- (7.0)	0.29 (----)	1.24 (----)
Carex sp.	----- (----)	----- (----)	----- (----)	4.0 (----)	----- (----)	----- (----)	----- (----)
Ceanothus foliosus	----- (----)	0.44 (0.44)	13.1 (27.7)	6.0 (1.3)	----- (----)	0.51 (----)	----- (----)
Ceanothus greggii	24.3 (14.5)	13.7 (13.7)	0.21 (----)	14.5 (8.8)	7.6 (7.7)	10.1 (11.9)	13.2 (12.8)
Ceanothus oliganthus	----- (----)	----- (----)	2.2 (----)	----- (----)	----- (----)	0.17 (----)	----- (----)
Ceanothus palmeri	0.78 (----)	----- (----)	----- (----)	0.34 (----)	----- (11.8)	----- (----)	----- (----)
Cercocarpus betuloides	1.3 (----)	----- (----)	0.45 (----)	----- (----)	----- (----)	0.4 (----)	----- (----)
Cupressus	22.3 (----)	1.0 (----)	12.5 (----)	31.0 (----)	21.8 (----)	36.1 (----)	20.0 (----)
Garrya flavescens ssp. flav.	----- (----)	----- (----)	0.75 (----)	----- (1.1)	----- (----)	----- (----)	----- (----)
Herbs	----- (----)	----- (----)	4.2 (9.4)	3.3 (0.42)	----- (----)	----- (----)	----- (----)
Heteromeles arbutifolia	4.0 (1.5)	0.55 (0.55)	----- (----)	1.8 (0.31)	2.0 (----)	1.9 (3.7)	1.5 (----)
Lonicera subspicata	0.33 (----)	----- (----)	----- (----)	0.74 (----)	0.13 (----)	----- (----)	----- (----)
Muhlenbergia rigens	17.6 (----)	----- (----)	----- (----)	7.6 (3.4)	----- (----)	----- (----)	----- (----)
Pinus coulteri	2.2 (----)	----- (----)	----- (----)	----- (----)	----- (----)	----- (----)	----- (----)
Platanus racemosa	1.8 (----)	----- (----)	----- (----)	----- (----)	----- (----)	----- (----)	----- (----)
Quercus agrifolia	----- (----)	----- (----)	----- (----)	0.8 (----)	----- (----)	----- (----)	----- (----)
Quercus chrysolepis	----- (----)	----- (----)	----- (----)	2.9 (----)	6.1 (----)	2.0 (----)	----- (----)
Quercus dumosa	32.8 (8.3)	9.3 (9.3)	----- (----)	3.4 (10.5)	9.7 (14.1)	10.8 (11.3)	24.4 (5.8)
Quercus wislizenii	----- (----)	----- (----)	0.94 (5.0)	8.7 (----)	----- (----)	1.0 (----)	1.5 (----)
Rhamnus californica	----- (----)	----- (----)	0.21 (----)	0.75 (3.1)	----- (----)	----- (----)	----- (----)
Rhamnus crocea	0.97 (----)	2.0 (2.0)	----- (----)	----- (----)	1.7 (----)	0.24 (1.2)	2.1 (1.0)
Rhus ovata	1.3 (----)	----- (----)	----- (----)	----- (----)	----- (----)	0.67 (----)	----- (----)
Rosa californica	2.8 (----)	----- (----)	----- (----)	3.1 (2.2)	----- (----)	----- (----)	----- (----)
Salvia sonomensis	----- (----)	----- (----)	10.2 (22.2)	4.79 (3.9)	1.0 (----)	2.0 (7.7)	----- (----)
Toxicodendron diversilobum	----- (----)	----- (----)	----- (----)	0.04 (----)	----- (----)	----- (----)	----- (----)
Trichostema lanatum	----- (----)	0.55 (0.55)	----- (----)	----- (----)	----- (----)	----- (----)	----- (----)
Yucca whipplei	0.78 (1.9)	1.3 (1.3)	----- (----)	----- (----)	----- (1.2)	0.28 (0.33)	----- (0.66)
OPEN	3.2 (9.6)	9.9 (9.9)	41.2 (37.9)	17.9 (13.6)	14.0 (11.8)	8.0 (13.9)	4.6 (14.1)
TOTAL LIVE COVER	90.5 (86.7)	87.1 (87.1)	48.8 (58.9)	80.1 (84.5)	80.5 (84.8)	84.2 (83.7)	92.2 (81.5)

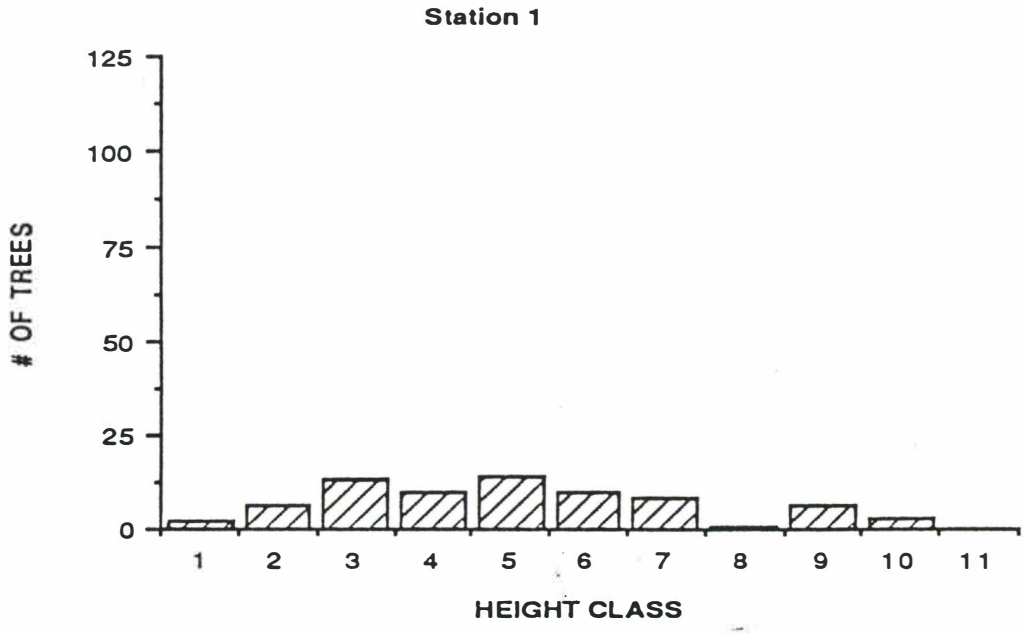


FIGURE 7. Height distribution for trees sampled at station 1. Height classes are at 1 meter intervals (e.g. class 1= 0-1 meters, class 2= 1-2 meters, etc.)

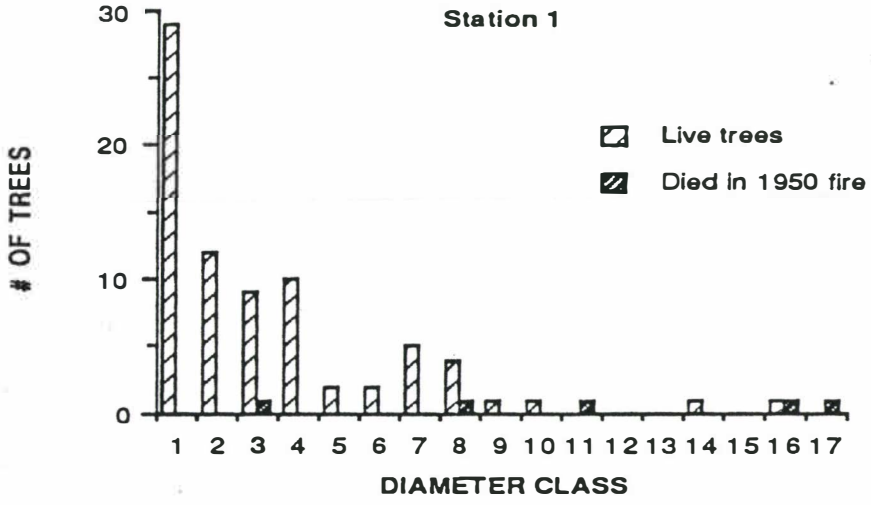


FIGURE 8. Distribution of the diameter @ 10 cm for trees sampled at station 1. Diameter classes are at 5 cm intervals (e.g. class 1= 0-5 cm, class 2= 5-10 cm, etc.)

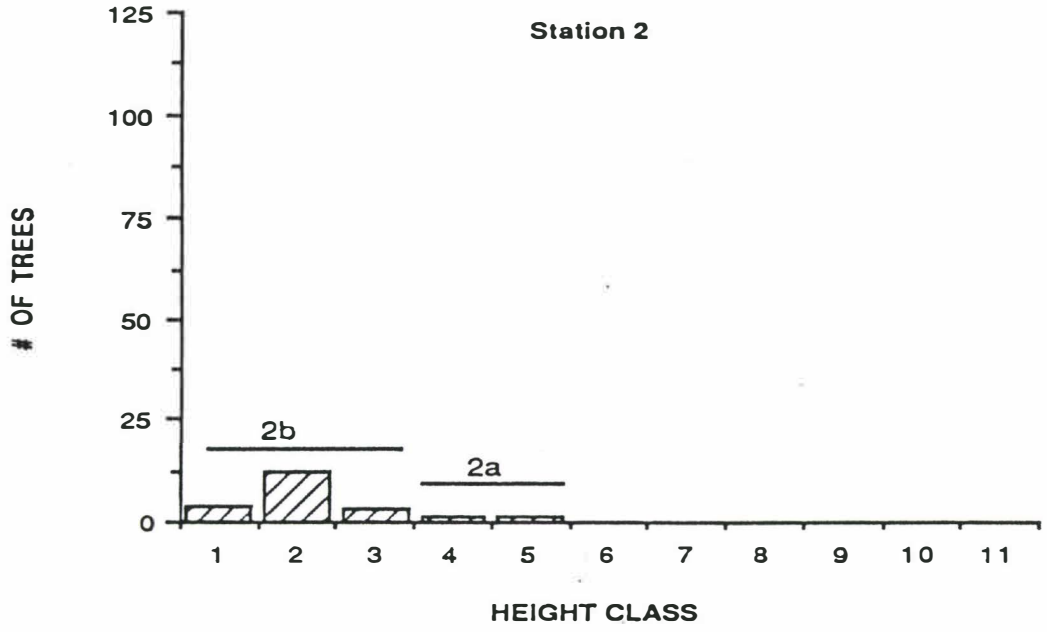


FIGURE 10. Height distribution for trees sampled at station 2. Trees at substation 2a are approximately 82 yrs. old while trees at 2b are only 38 yrs. old. Height classes are at 1 meter intervals (e.g. class 1= 0-1 meter, class 2= 1-2 meters, etc.).

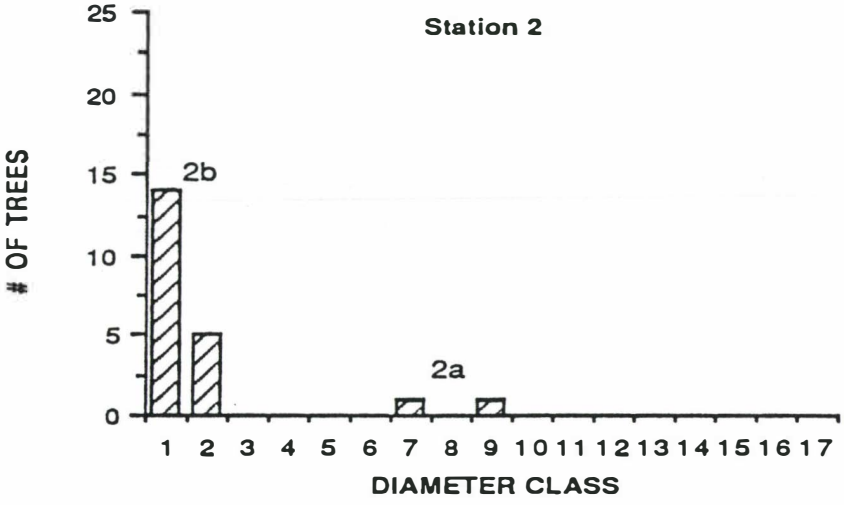


FIGURE 11. Distribution of diameters @ 10 cm for sampled trees at station 2 shows size differences between substations due to age. Diameter classes are at 5 cm intervals (e.g. class 1= 0-5 cm, class 2= 5-10 cm, etc.).

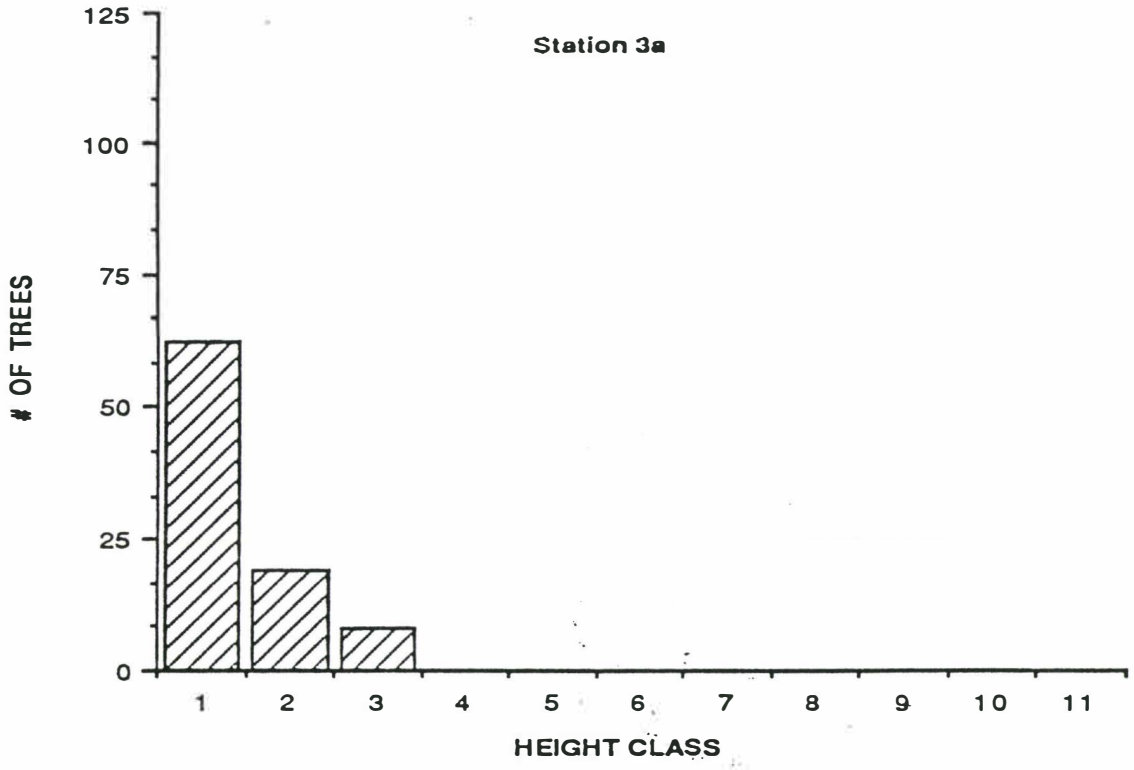


FIGURE 13. Height distribution for trees sampled at substation 3a which occurs on state park land. The high number of trees in class one is due to the large number of stunted trees occurring in this area. Height classes are at 1 meter intervals (e.g. class 1 = 0-1 meter, class 2= 1-2 meters, etc.).

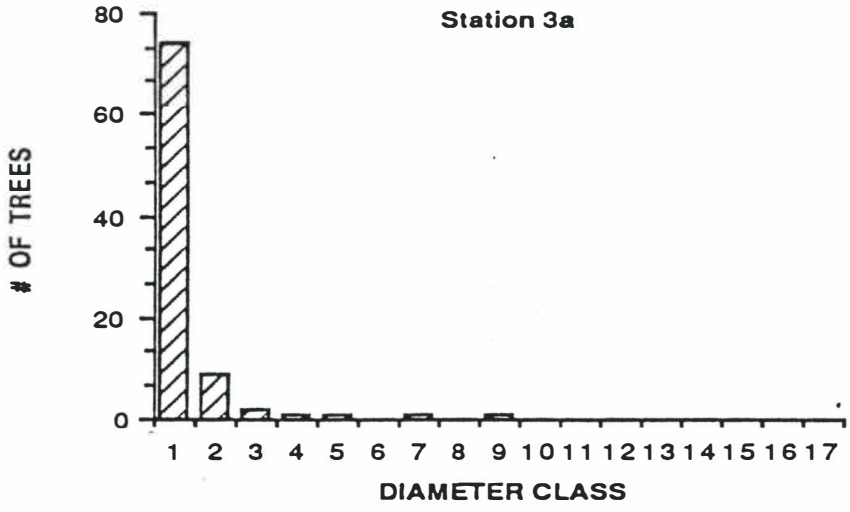


FIGURE 14. Distribution of diameters @ 10 cm for sampled trees at substation 3a. Large number of trees in diameter class 1 is due to high number of stunted individuals occurring in this area. Diameter classes are at 5 cm intervals (e.g. class 1= 0-5 cm, class 2= 5-10 cm, etc.).

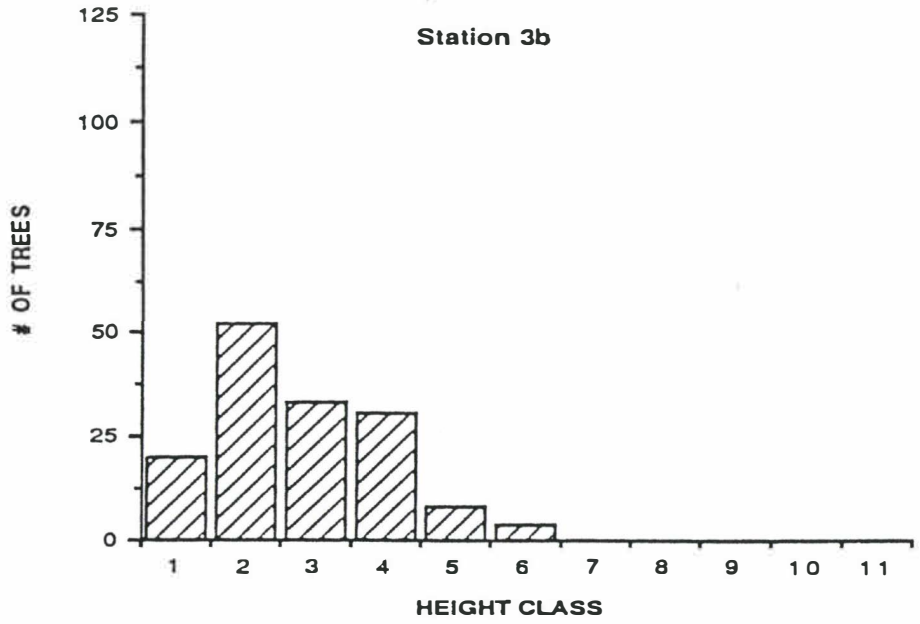


FIGURE 17. Height distribution for sampled trees of substation 3b which occurs on state park land. Height classes are at 1 meter intervals (e.g. class 1= 0-1 meter, etc.).

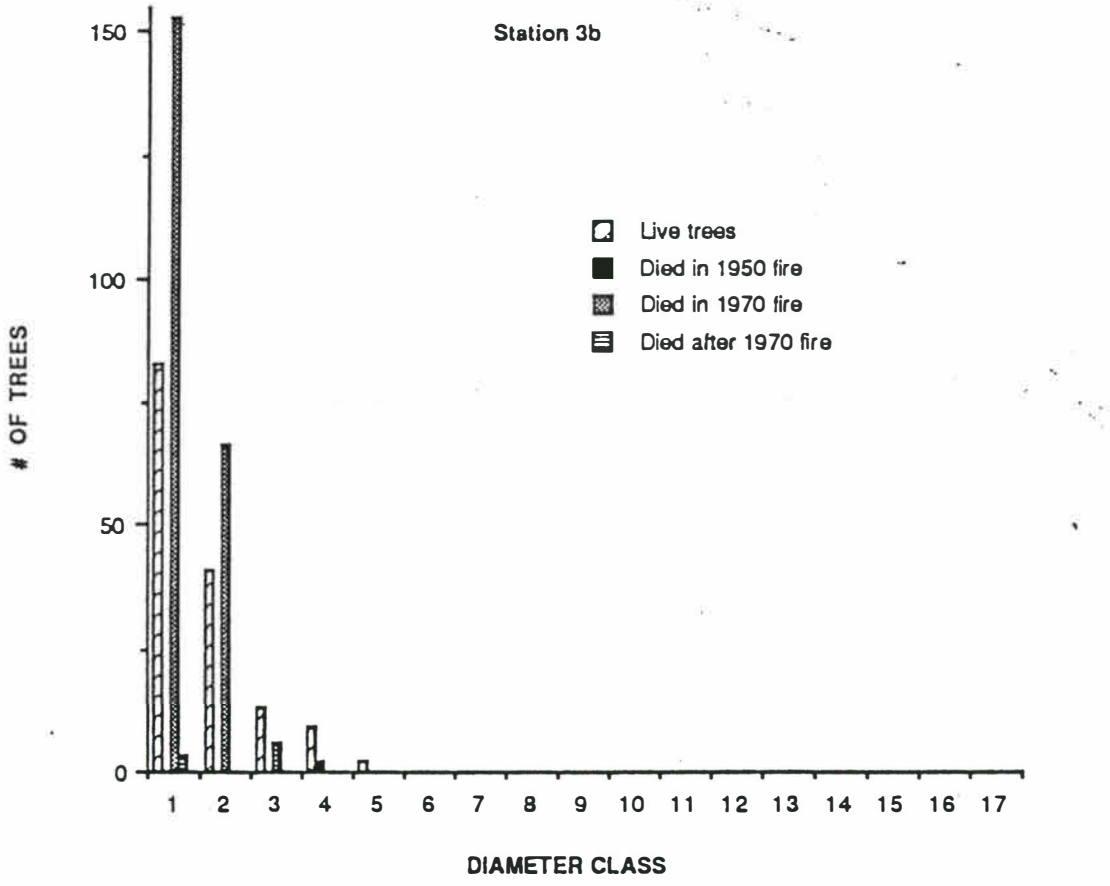


FIGURE 18. Distribution of diameters @ 10 cm for sampled trees of substation 3b shows the reduction in the number of trees after the 1970 Boulder fire (compare live trees with Died in 1970 fire). Diameter classes are at 5 cm intervals (e.g. class 1= 0-5 cm, class 2= 5-10 cm, etc.).

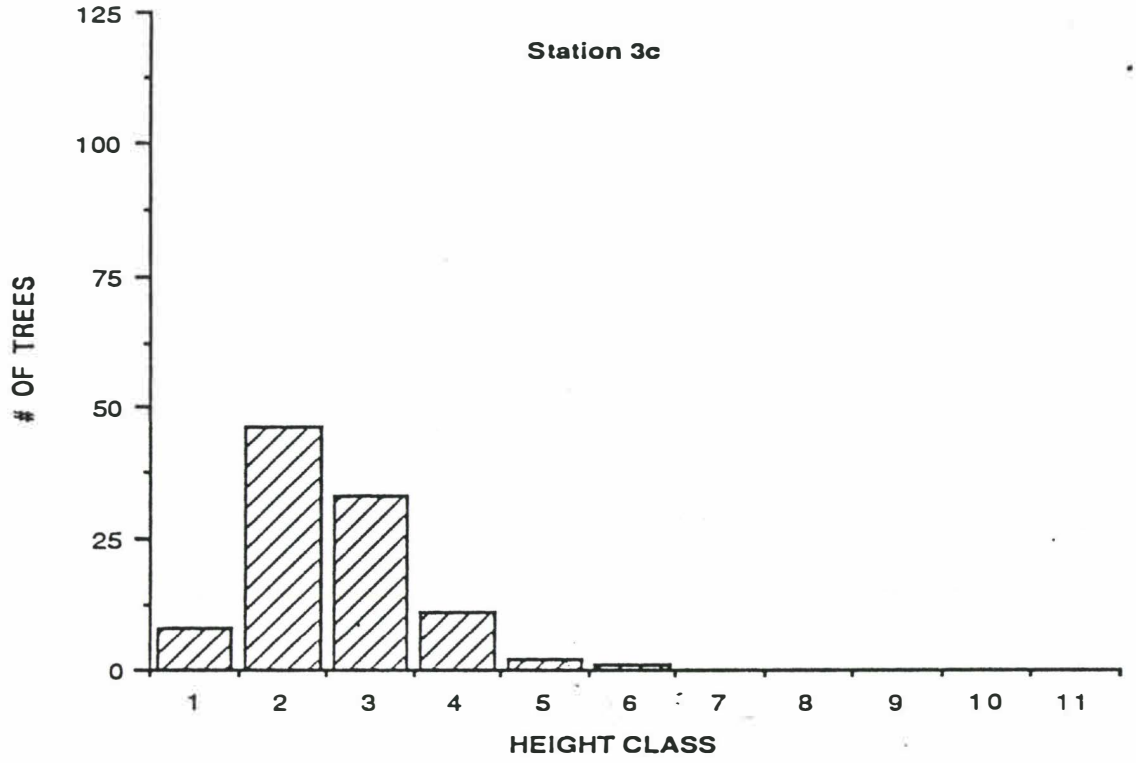


FIGURE 20. Height distribution for trees sampled at substaion 3c which occurs on forest service land. Height classes are at 1 meter intervals (e.g. class 1= 0-1 meter, class 2= 1-2 meters, etc.).

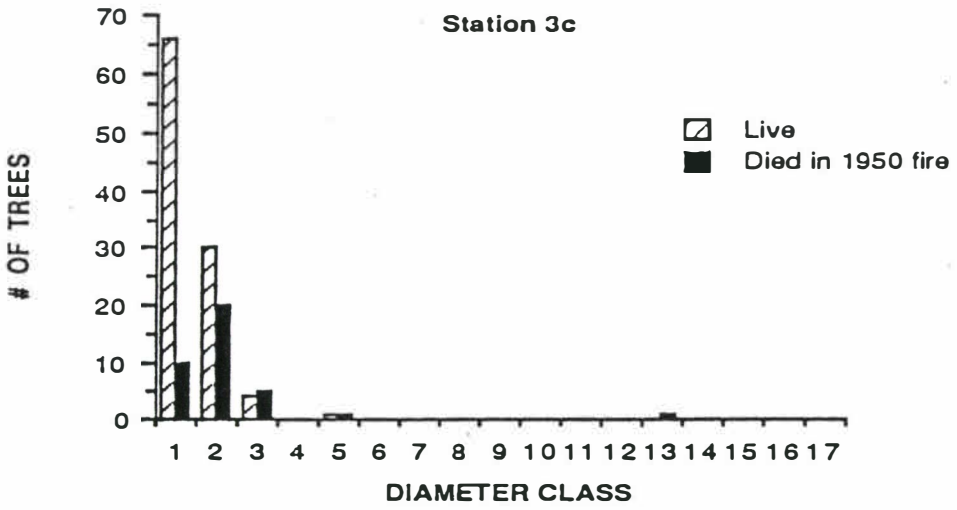


FIGURE 21. Distribution of diameters @ 10 cm for sampled trees at substation 3c shows how the number of trees in this area appears to have increased after the 1950 Conejos fire (compare live to dead). Diameter classes are at 5 cm intervals (e.g. class 1= 0-5 cm, class 2= 5-10 cm, etc.).

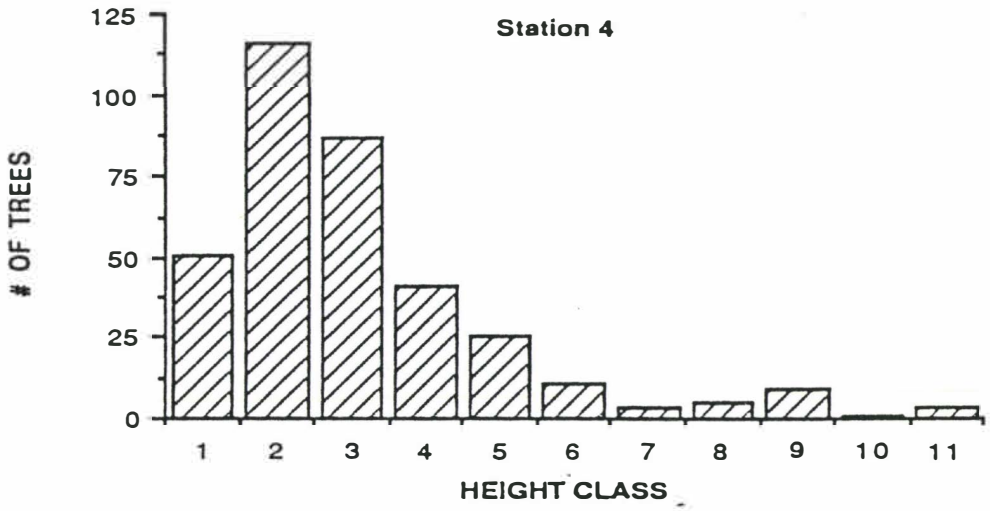


FIGURE 24. Height distribution for sampled trees at station 4. Height classes are at 1 meter intervals (e.g. class 1= 0-1 meter, class 2= 1-2 meters, etc.).

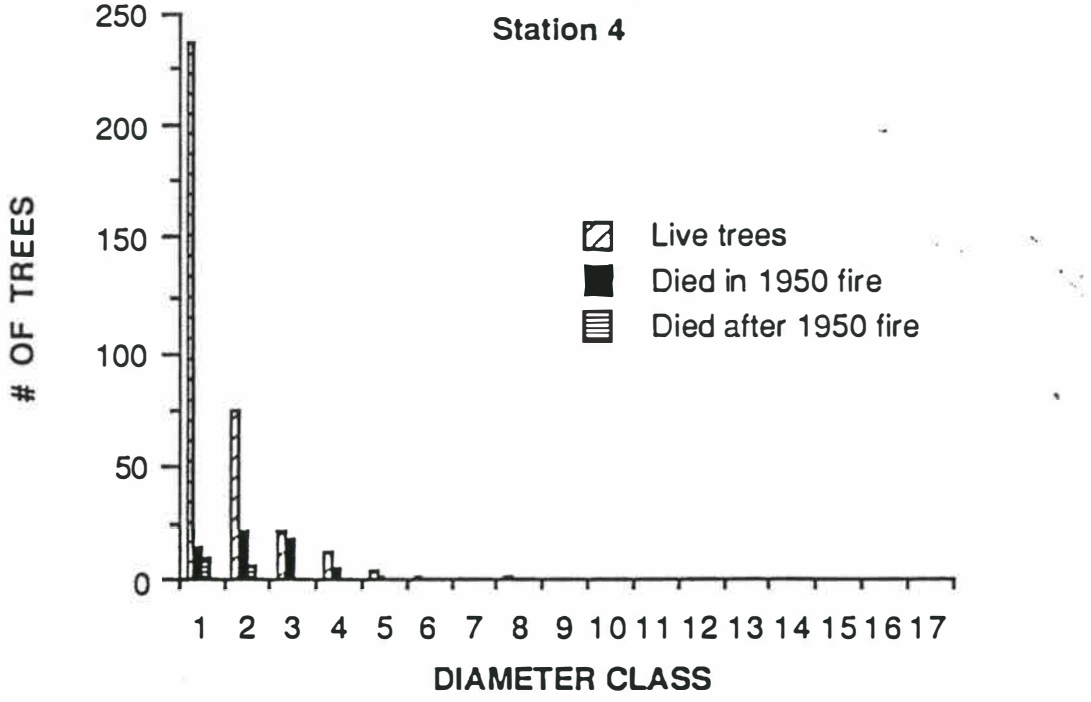


FIGURE 25. Distribution of diameters @ 10 cm for sampled trees at station 4 showing how the number of trees appears to have increased after the 1950 Conejos fire. Those trees that died after the 1950 fire probably represent stand thinning deaths. Diameter classes are at 5 cm intervals (e.g. class 1= 0-5 cm, class 2= 5-10 cm, etc.).

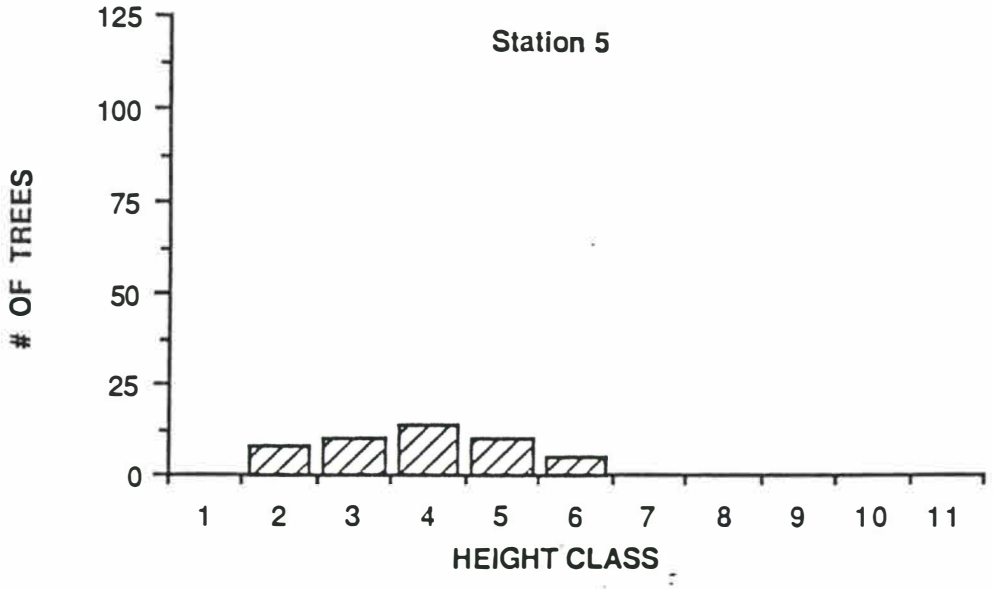


FIGURE 26. Height distribution for sampled trees at station 5. These trees grow in dense chaparral, thus they lack the smallest size class due to the stature of the shrubs. Height classes are at 1 meter intervals (e.g. class 1= 0-1 meter, class 2= 1-2 meters, etc.).

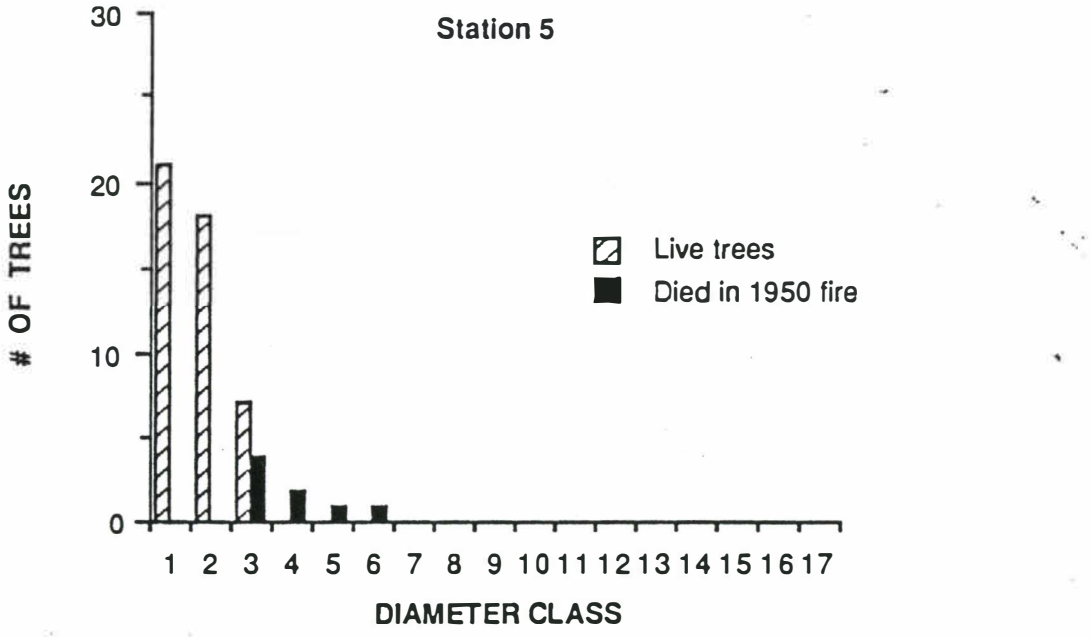


FIGURE 27. Distribution of diameters @ 10 cm for trees sampled from station 5 shows an increase in the number of trees after the 1950 Conejos fire (compare live to dead trees). Trees burned in 1950 were approximately 70-80 years old and presently the age of the live trees is about 38 yrs. old. Diameter classes are at 5 cm intervals (e.g. class 1= 0-5 cm, class 2= 5-10 cm, etc.).

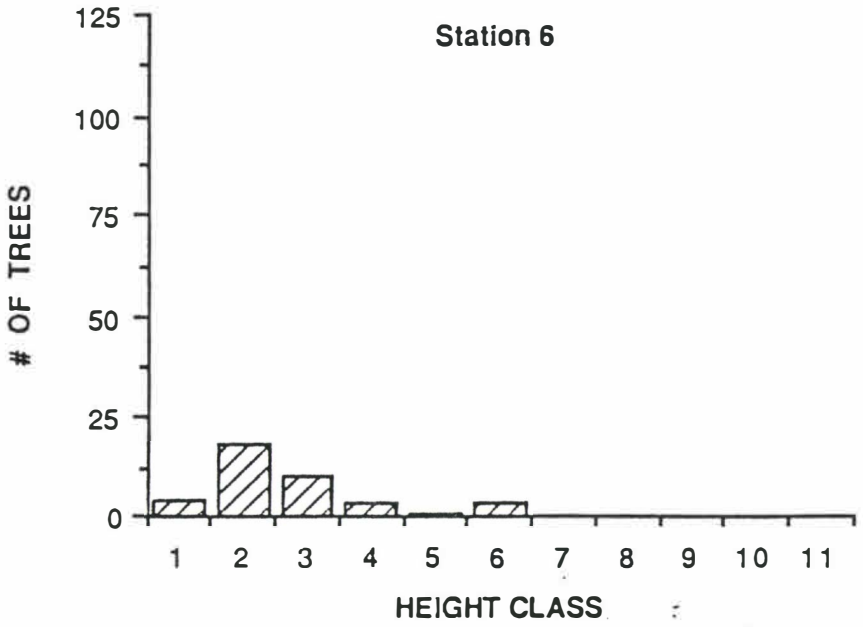


FIGURE 29. Height distribution for trees at station 6. This small grove of trees is heavily suppressed under a canopy of oaks and pines. Height classes are at 1 meter intervals (e.g. class 1= 01- meter, class 2= 1-2 meters, etc.).

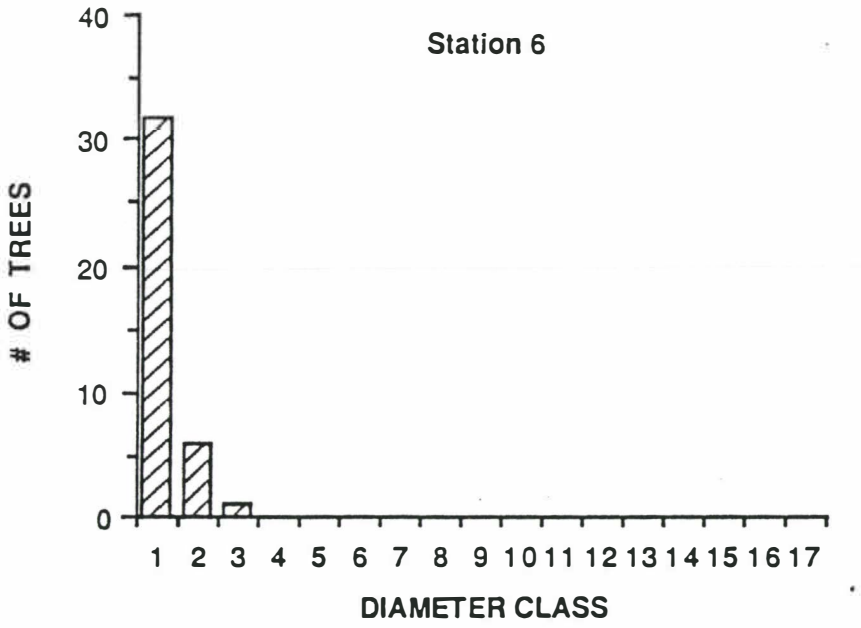


FIGURE 30. Distribution of diameters @ 10 cm for trees at station 6. Restriction of trees in the smaller diameter classes is due to heavy suppression of the 38 year old cypress by the surrounding trees and shrubs. Diameter classes are at 5 cm intervals (e.g. class 1= 0-5 cm, class 2= 5-10 cm, etc.).

Table 3. Results showing the differences in vegetation cover of dominant species between areas containing cypress and areas without cypress. Analysis performed on arcsin-square root transformed values. (* $P \leq .001$)

Source:	d.f.	F-test
Area	1	0.51
Species	5	*12.66
Area x Species	5	0.93
Error	72	

Table 4. Overall mean percent cover values for dominant species occurring in areas with and without cypress.

Species	Cypress Area	Non-cypress Area
Adenostoma fasciculatum	27.4	46.6
Arctostaphylos glandulosa	10.6	12.6
Ceanothus foliosus	2.8	4.2
Ceanothus greggii	11.9	9.9
Quercus dumosa	12.9	8.5
Salvia sonomensis	2.5	4.8
Cupressus arizonica ssp. stephensonii	21.9	0.0

TABLE 5. Results showing differences between cypress stations for tree height, diameter @ 10 cm., and diameter at breast height (dbh). Analysis of variance performed on log transformed values. (*P≤.0001)

Source:	d.f.	F-test Height	F-test Dia.@10cm.	d.f.	F-test DBH
Between stations	8	*45.17	*16.45	8	*12.37
Within stations	864			624	
Total	872			632	

Table 6. Mean values and range for tree height of Cupressus arizonica ssp. stephensonii by station. (± std. dev.)

Station	n	Height (m)	Minimum	Maximum
18 yr.				
3a	89	0.89 ± .64	1.80	2.90
3b	148	2.28 ± 1.1	3.90	5.90
38 yr.				
1	77	4.78 ± 2.4	1.10	10.00
2a	2	4.95 ± 6.3	4.50	5.40
2b	19	1.37 ± .61	1.30	2.30
3c	101	2.02 ± .83	0.57	5.20
4	352	2.54 ± 1.8	1.90	10.50
5	46	3.39 ± 1.1	1.26	5.40
6	39	2.15 ±1.1	0.23	5.00

Table 7. Mean values and range for tree girth of Cupressus arizonica ssp. stephensonii by station. (± std. dev.)

Station	Dia. @ 10 cm (cm)	Min.	Max.	DBH (cm)	Min.	Max.
18 yr.						
3a	4.1 ± 6.2	0.6	43.0	2.1 ± 1.9	0	6.9
3b	6.0 ± 4.7	0.8	23.9	3.3 ± 3.0	0	17.4
38 yr.						
1	14.4 ± 14.9	0.3	75.0	9.1 ± 9.2	0	47.5
2a	37.0 ± 7.2	31.9	42.1	19.3 ± 3.2	17	21.6
2b	3.7 ± 1.9	0.4	6.8	1.4 ± .90	0.2	2.7
3c	4.6 ± 3.1	0.5	23.0	2.4 ± 1.7	0.3	10.1
4	4.9 ± 4.8	0.3	39.7	3.8 ±4.1	0.2	35.6
5	5.9 ± 3.3	1.3	14.4	4.0 ± 2.4	0.3	10.4
6	3.3 ± 2.5	.07	10.5	1.9 ± 2.0	0.3	7.2

TABLE 8. Results showing differences between trees growing in two locations (chaparral vs. drainage) and factored by age (18 yr vs. 38 yr) for height, diameter at 10 cm., and diameter at breast height (dbh). The two-way analysis of variance was performed on log transformed values. (* $P \leq .01$; ** $P \leq .001$)

Source:	d.f.	Height	Dia@10cm	d.f.	DBH
Age	1	**31.04	0.18	1	1.63
Location	1	**122.70	**22.76	1	**33.11
Age x Location	1	**46.50	**29.83	1	*6.94
Error	869			629	

Table 9. Mean values for height, diameter @ 10 cm., and diameter at breast height (dbh) for trees growing in two locations within two age classes.

Age:	18 yr.		38 yr.	
Location: (n)	Chaparral (152)	Drainage (85)	Chaparral (198)	Drainage (438)
Height (m)	1.16 ±0.7	2.81 ±1.1	2.08 ±0.9	3.04 ±2.1
Dia.@ 10cm (cm)	4.0 ±5.0	7.5 ±5.4	5.1 ±4.5	6.4 ±8.4
DBH (cm)	1.7 ±1.5	4.1 ±3.2	2.7 ±2.7	4.9 ±6.0

TABLE 10. Results showing differences between cypress stations for the number of immature and mature cones per tree both good and open. Analysis of variance performed on square-root transformed values. (*P≤ .01; **P≤ .001)

		F-test			
Source:	d.f.	Immature	Immature parasitized	Mature	Mature open
Between stations	8	*3.21	1.57	**7.89	*2.78
Within stations	864				
Total	872				

Table 11. Means and range for immature and mature cones per tree both good and open for Cupressus arizonica ssp. stephensonii by station (± std. dev.)

Station	Immature cones	Min.	Max.	Parasitized immature	Min.	Max.
18 yr.						
3a	1.10 ±4.8	0	41	0.5 ±2.2	0	13
3b	4.2 ±17.9	0	167	3.8 ±18.3	0	140
38 yr.						
1	4.9 ±14.0	0	73	0.9 ±3.2	0	19
2a	10.0 ±14.1	0	20	0	0	0
2b	1.10 ±4.5	0	20	0.4 ±1.3	0	6
3c	4.4 ±20.3	0	195	0.6 ±3.3	0	23
4	1.60 ±5.0	0	45	1.6 ±6.6	0	56
5	1.00 ±4.1	0	26	0.8 ±4.2	0	28
6	0.15 ±0.8	0	5	0	0	0

	Mature cones	Min.	Max.	Mature Open	Min.	Max.
18 yr.						
3a	21.90 ±83.6	0	682	0	0	0
3b	25.60 ±51.1	0	413	0.1 ±1.2	0	15
38 yr.						
1	71.7 ±332.0	0	2853	1.5 ±7.0	0	50
2a	517.0 ±731.1	0	1034	0	0	0
2b	6.30 ±10.6	0	36	0.3 ±1.3	0	6
3c	33.20 ±63.9	0	418	0.5 ±2.2	0	17
4	23.40 ±44.4	0	361	3.1 ±24	0	377
5	29.30 ±51.0	0	237	0.6 ±1.8	0	10
6	0.46 ±0.99	0	4	0	0	0

TABLE 12. Results showing differences between trees growing in two locations (chaparral vs. drainage) and factored by age (18 yr vs. 38 yr.) for immature cones both good and open, and mature cones both good and open. The two-way analysis of variance was performed on square-root transformed values. (* $P \leq .05$; ** $P \leq .01$; *** $P \leq .001$)

Source:	d.f.	Immature	Immature open	Mature	Mature open
Age	1	1.65	1.93	1.61	**8.93
Location	1	*6.52	*3.87	0.97	2.38
Age x Location	1	***18.31	***17.06	**8.19	1.14
Error	869				

Table 13. Mean values for immature and mature cones per tree both good and open for cypress trees growing in two locations within two age classes.

Age:	18 yr.		38 yr.	
Location:	Chaparral	Drainage	Chaparral	Drainage
Immature cones	1.9	5.0	3.3	1.8
Immature parasitized	1.0	5.3	1.7	0.9
Mature cones	21.2	29.5	31.7	30.5
Mature open	0	0.2	0.6	2.7

TABLE 14. Results of a mutiple regression for predicting the number of mature cones from a combination of factors. Important parameters and their standard values are listed. (* $P \leq .001$)

Source:	d.f.	F-test
Regression	5	*80.19
Residual	828	
Total	833	

$R^2 = .326$

Parameter:	Std. Value
Dia. @ 10cm	*0.366
Immature cones/tree	*0.176
Open Mature cones/tree	*0.154
Station	*0.149
Open immature cones/tree	*0.145

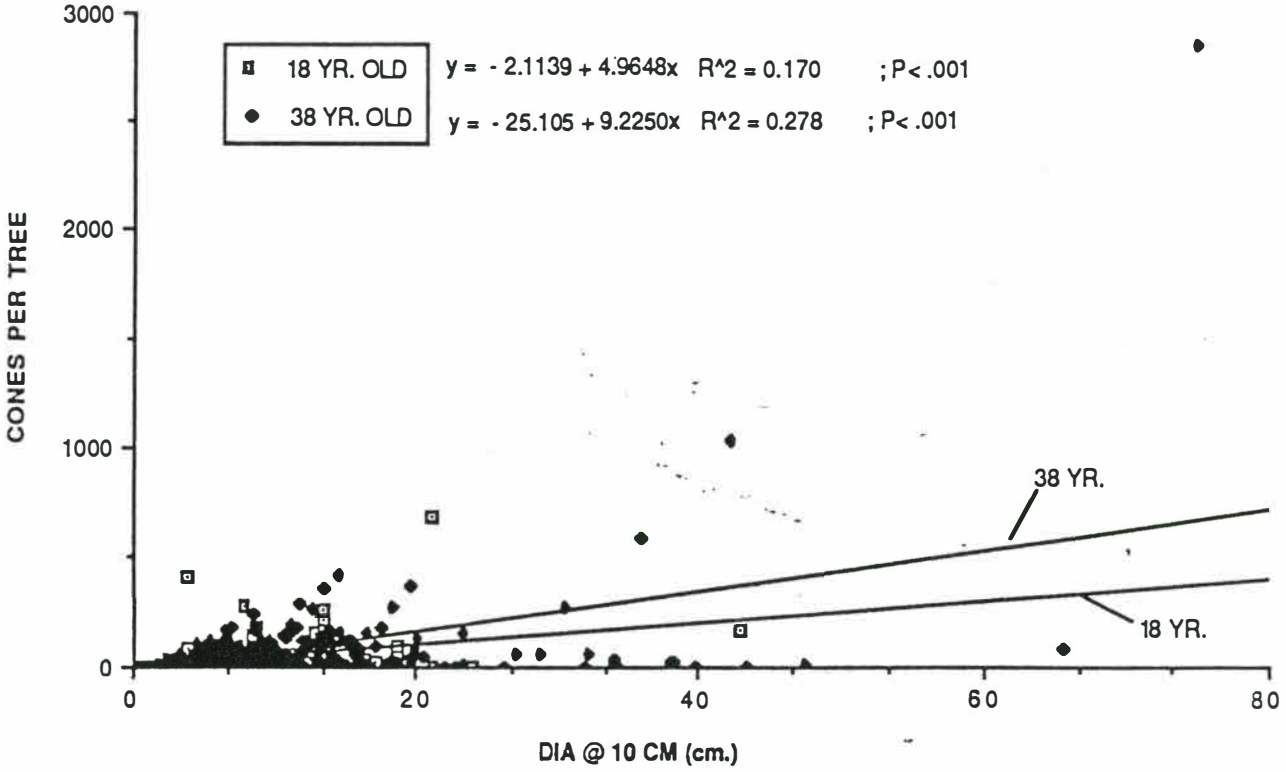


FIGURE 31. Relationship between cones per tree and tree diameter at 10 centimeters for each age group supports the idea that tree diameter is a good predictor of cone production.

TABLE 15. Means for the proportion of trees having male cones, young female cones, neither, or both for each cypress station expressed as a percentage. Averages are based on data collected from transects (n) within each station. Young female cones were those which were being pollinated between August-December 1987.

	% TREES			
Reproductive Status:	No Male No Female	Male No Female	No Male Female	Male Female
STATION (n)				
18 yr.				
3a (3)	2.38	46.43	38.1	13.1
3b (5)	12.75	24.16	30.2	32.89
38 yr.				
1 (4)	10.39	20.78	28.57	40.26
2 (2)	4.76	14.29	52.38	28.57
3c (2)	3.96	11.88	37.62	46.53
4 (4)	18.98	28.61	23.23	29.18
5 (2)	2.17	6.52	28.26	63.04
6 (1)	38.46	56.41	2.56	2.56
AGE				
18 YR.	9.01	32.19	33.05	25.75
38 YR.	15.09	24.69	26.26	33.96

TABLE 16. Means for the proportion of trees having mature female cones for each cypress station expressed as a percentage. Averages are based on data collected from transects (n) within each station.

	% Trees with Mature Female Cones
STATION (n)	
18 yr.	
3a (3)	31.46
3b (5)	71.81
38 yr.	
1 (4)	79.22
2 (2)	57.14
3c (2)	77.23
4 (4)	71.70
5 (2)	76.09
6 (1)	23.08
AGE	
18YR.	56.72
38 YR.	70.38

Table 17. Overall mean values for cypress cone characteristics (n=100). Values in parentheses are standard deviations.

Cone Character	Mean	St. Dev.	Max.	Min.
Length (mm)	22.7	2.8	29.8	17.3
Width (mm)	20.3	1.8	25.2	15.7
# of Scales/cone	7.1	1.1	10.0	5.0
# of Seeds/cone	82.1	16.1	130.0	51.0

Table 18. Mean values of number of seeds per tree for each cypress station.

Station	n	Mean Seeds/tree
18 yr.		
3a	148	2,104.3
3b	89	1,796.6
38 yr.		
1	77	5,881.6
2a	2	42,394.0
2b	19	517.8
3c	101	2,728.7
4	352	1,920.4
5	46	2,410.1
6	39	37.8

Location:	Drainage	Chaparral
AGE		
18 yr.	2,422.3	1,746.2
38 yr.	2,503.2	2,601.2

Table 19. Estimates of reproductive capacity for each cypress station. Density values are mean densities determined by averaging transects within stations.

Station	Trees/m^2	Cones/m^2	Seeds/m^2
18 yr.			
3a	0.29	7.5	615.0
3b	0.29	6.4	524.8
Total	**0.29**	**7.1**	**588.6**
38 yr.			
1	0.075	5.3	434.6
2a	0.002	1.0	82.0
2b	0.018	0.1	8.2
3c	0.42	13.9	1,139.8
4	0.65	15.2	1,246.4
5	0.28	8.4	688.8
Total	**0.46**	**15.2**	**1,180.7**

Table 20. Estimated values comparing reproductive capacity between ages for Cupressus arizonica ssp. stephensonii.

Age	Seeds/tree	Trees/m^2	Cones/m^2
18 yr.	1,988.7	0.296	7.1
38 yr.	2,533.7	0.466	15.2

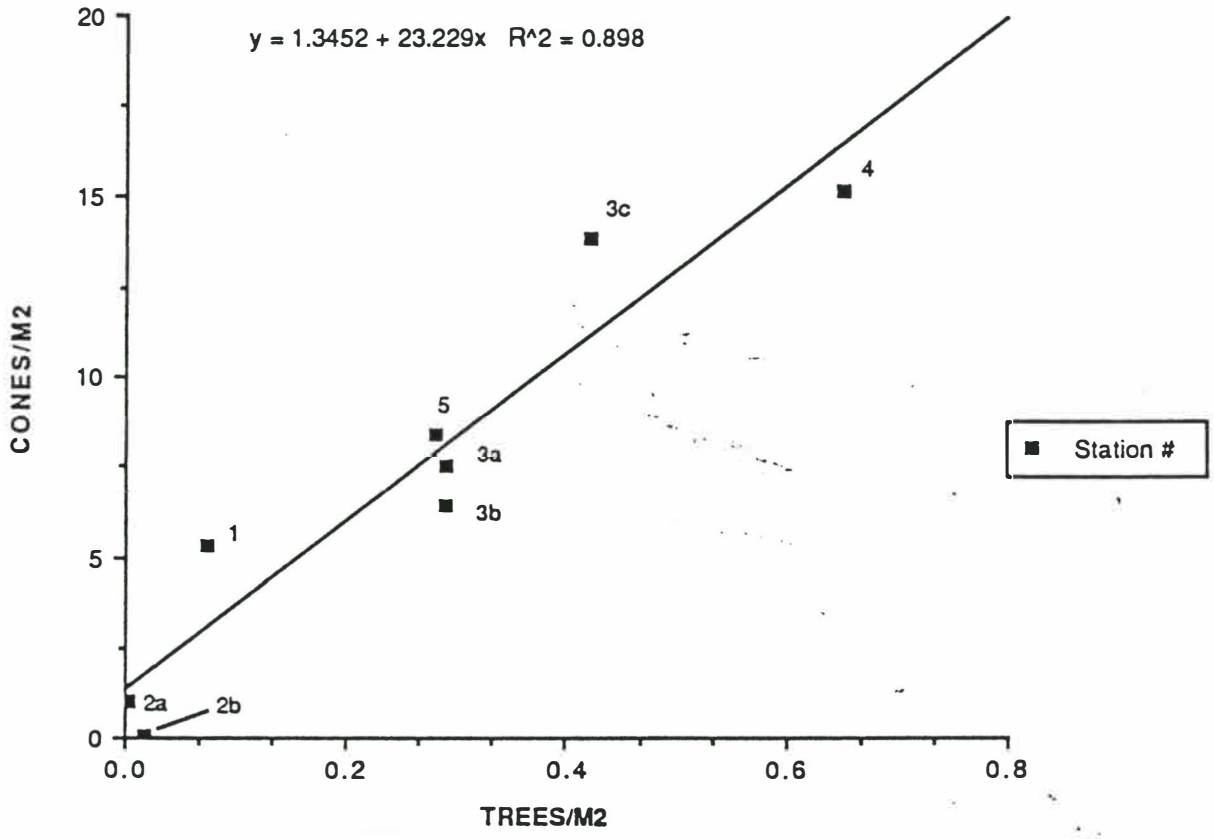


FIGURE 32. Relationship between cones per meter square and tree density shows that the number of cones per meter square increases as trees per meter square increases.

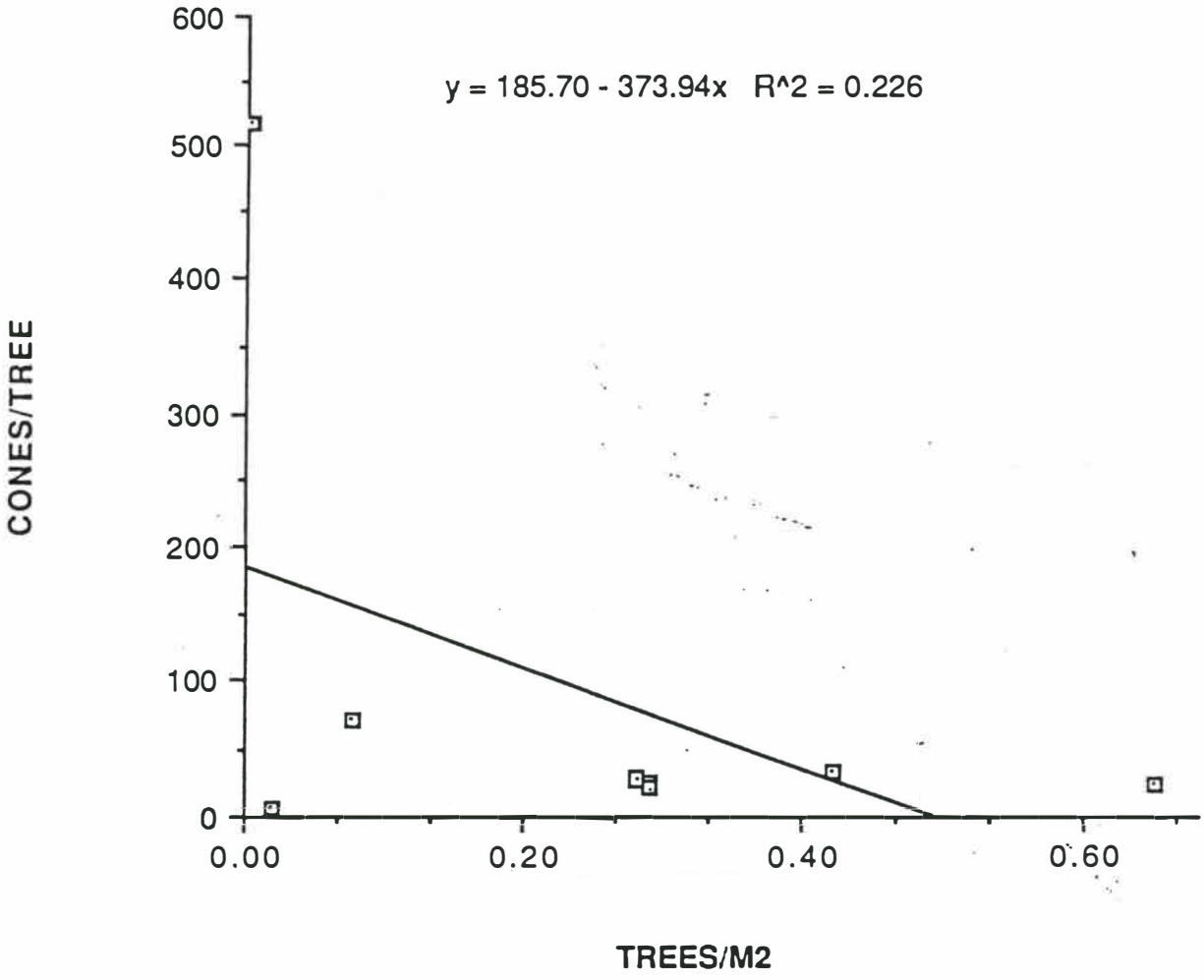
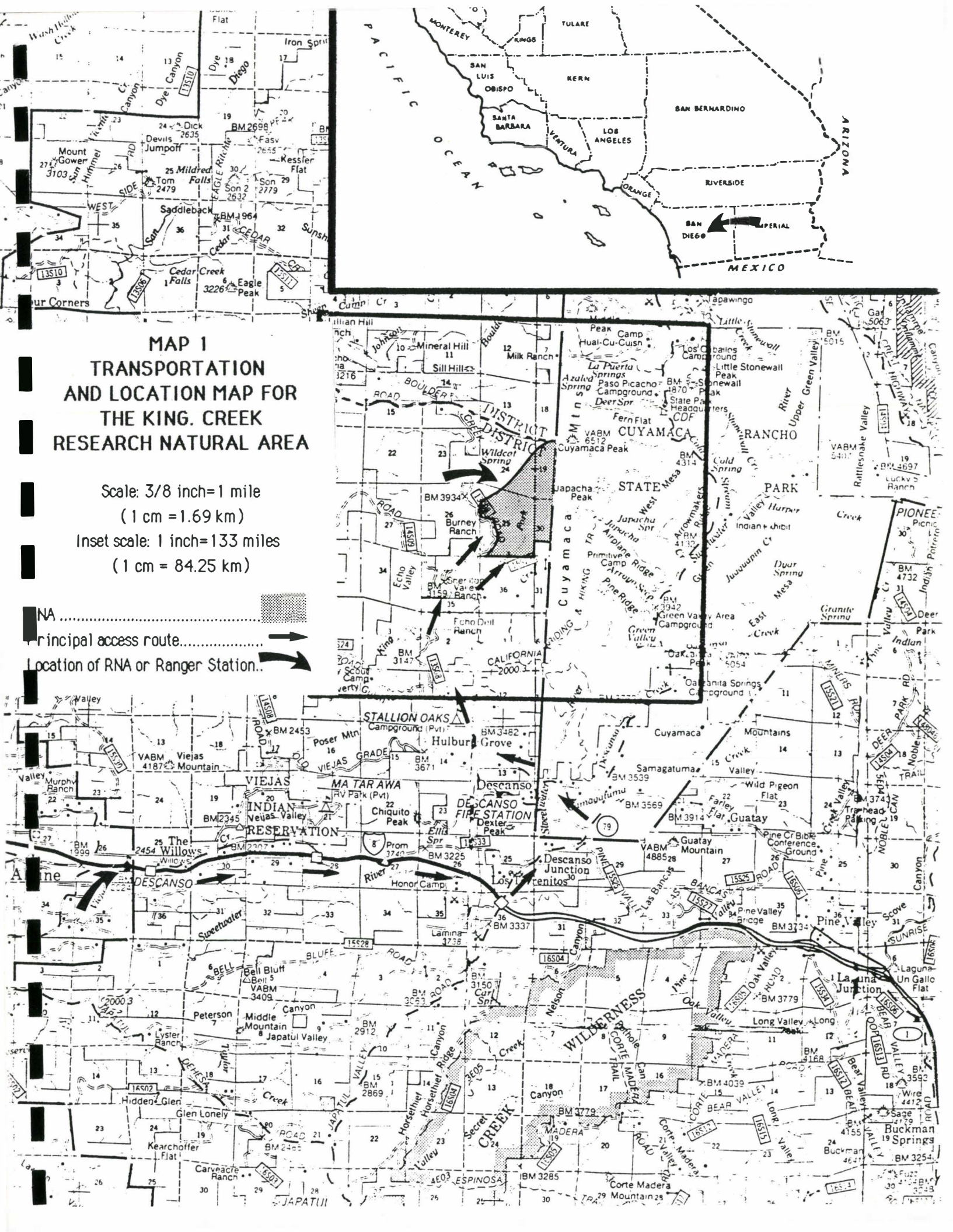
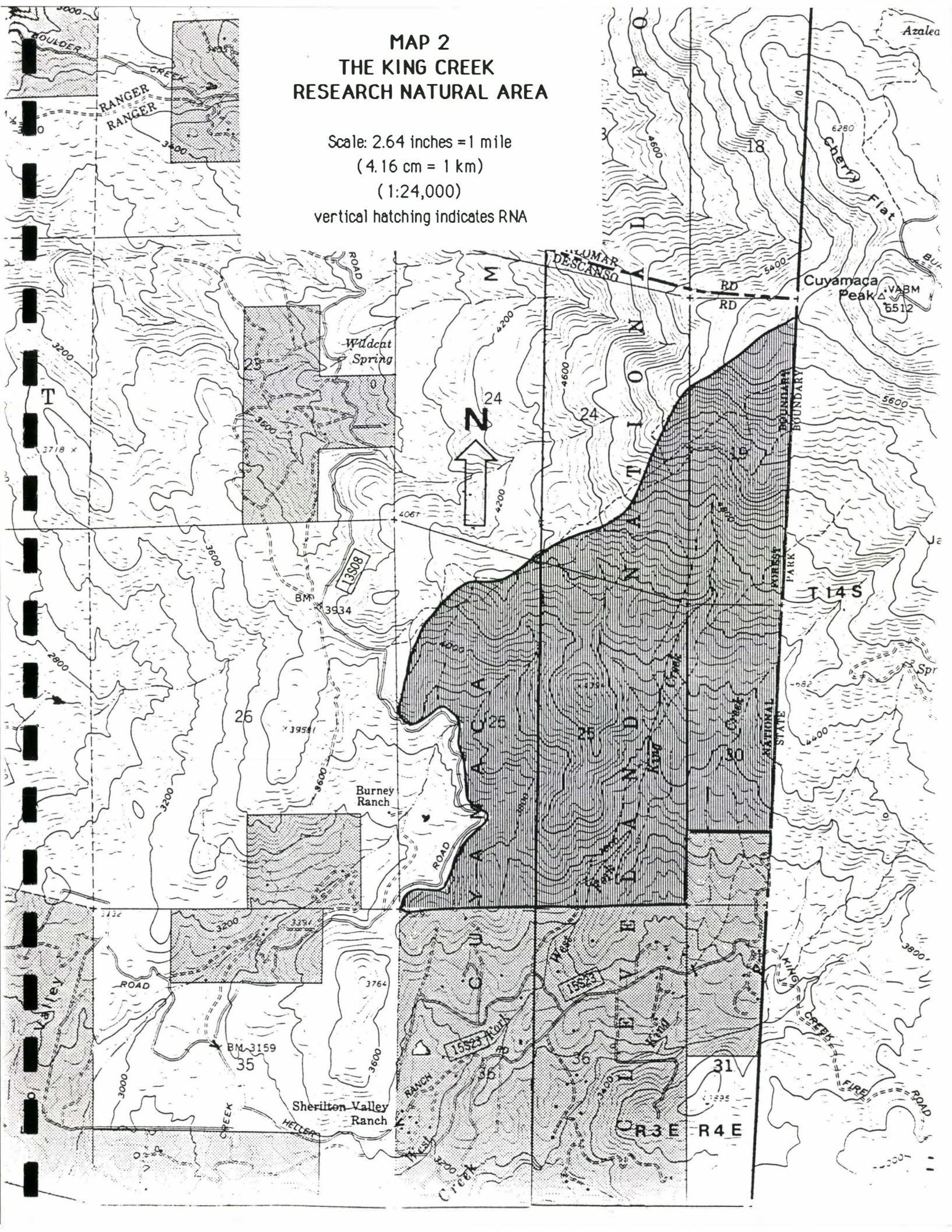


FIGURE 33. Relationship between the number of cones per tree and tree density shows that as trees per meter square increases the number of cones per tree decreases.

Table 21. Characteristics of old trees (assumed 90+ yrs. old) found throughout the cypress population.

Station	Height (m)	Dia @ 10 cm (cm.)	Mature cones	Seeds/tree
4	6.2	41.3	510	41,820
4	6.8	50.0	454	37,228
4	6.0	52.2	2,872	235,504
4	4.4	46.7	307	25,174
4	4.5	42.5	726	59,532
3c	5.0	52.2	129	10,578


MAP 1
TRANSPORTATION AND LOCATION MAP FOR THE KING. CREEK RESEARCH NATURAL AREA
Scale: 3/8 inch=1 mile
(1 cm =1.69 km)
Inset scale: 1 inch=133 miles
(1 cm = 84.25 km)
RNA .....
Principal access route.....
Location of RNA or Ranger Station..
PACIFIC OCEAN
MONTEREY
KINGS
TULARE
SAN LUIS OBISPO
KERN
SAN BERNARDINO
SANTA BARBARA
VENTURA
LOS ANGELES
ORANGE
RIVERSIDE
SAN DIEGO
IMPERIAL
ARIZONA
MEXICO
CUYAMACA RANCHO STATE PARK
DESCANSO
STALLION OAKS Campground (Pvt)
MA TAR AWA RV Park (Pvt)
VIEJAS INDIAN RESERVATION
DESCANSO FIRE STATION
Descanso Junction
Guatay
Guatay Mountain
Pine Valley
Laguna Junction
WILDERNESS
Secret CREEK
Buckman Springs
Corte Madera Mountain
Mount Gower
Devils Jumpoff
Saddleback
Cedar Creek Falls
Eagle Peak
Mineral Hill
Milk Ranch
Cuyamaca Peak
Burney Ranch
Echo Valley Ranch
Hulburt Grove
Viejas Mountain
Chiquito Peak
Dexter Peak
Honor Camp
Bell Bluff
Middle Mountain
Japatul Valley
Hidden Glen
Glen Lonely
Kearchoffer Flat
Carveacre Ranch
Oakzanita Springs Campground
Green Valley Area Campground
Paso Picacho Campground
Los Caballos Campground
Cuyamaca Mountains
Wild Pigeon Flat
Pine Valley Bridge
Pine Cr Bible Conference Ground
Laguna Un Gallo Flat
Long Valley
Buckman Springs
Corte Madera
ESPINOSA
JAPATUL

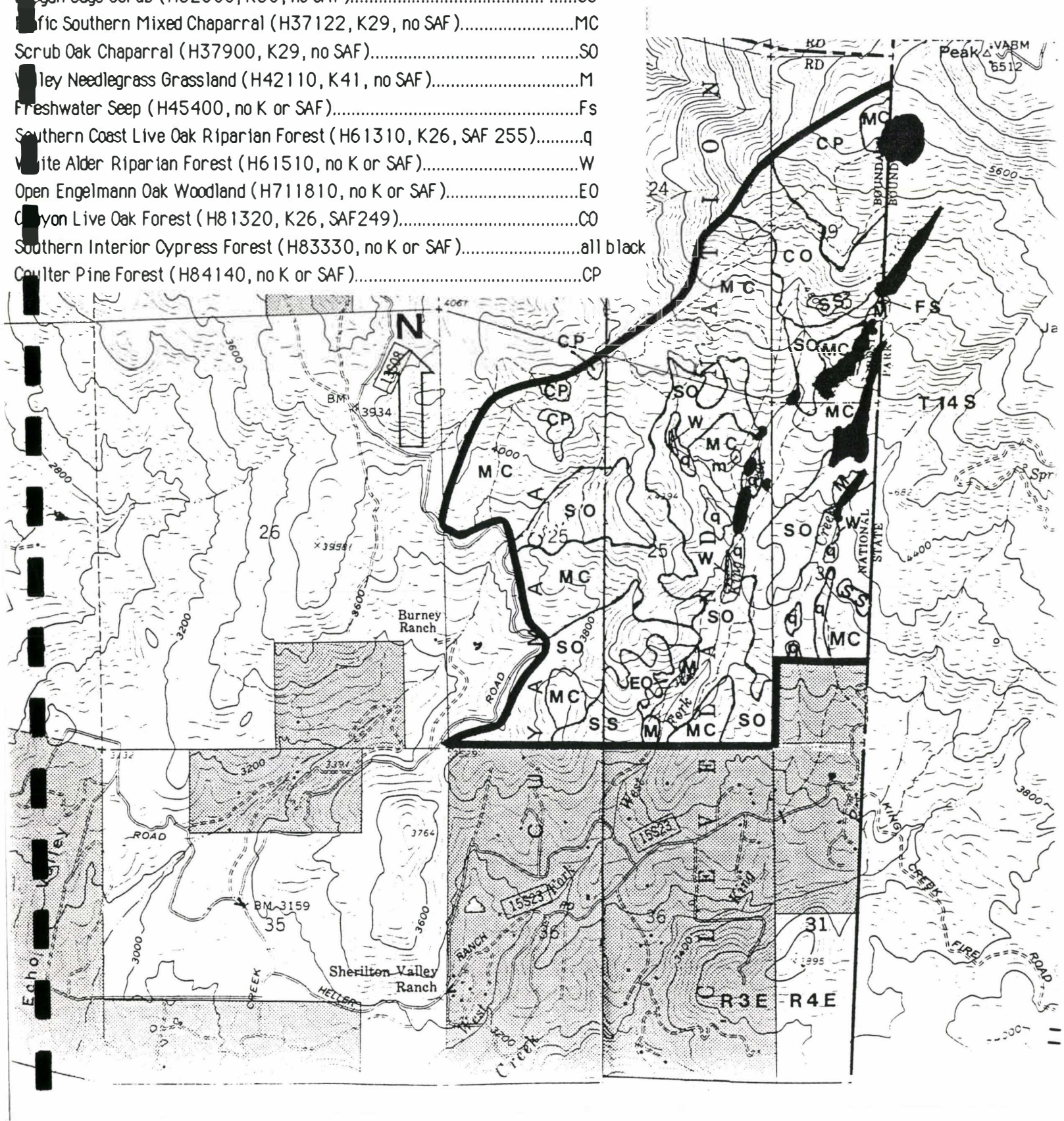

MAP 2
THE KING CREEK
RESEARCH NATURAL AREA
Scale: 2.64 inches = 1 mile
(4.16 cm = 1 km)
(1:24,000)
vertical hatching indicates RNA
Azalea
Cherry Flat
Cuyamaca Peak △ VABM 6512
DESCANSO
RD
RD
Wildcat Spring
BOULDER CREEK
RANGER
RANGER
ROAD
Burney Ranch
ROAD
Sherilton Valley Ranch
HELLER
CREEK
BM 3159
BM 3934
1S08
15S23
15S23 Road
West Kitchen Creek Road
Kitchen Creek Road
RANCH
FIRE ROAD
KING CREEK
Creek
Cuyamaca Valley
Cuyamaca Valley
Cuyamaca Valley

MAP 3
VEGETATION MAP
KING CREEK
RESEARCH NATURAL AREA

Scale: 2.64 inches = 1 mile
(4.16 cm = 1 km)
(1:24,000)

Legend

vegetation type (with Holland, Kuchler, and SAF type equivalents)	symbol
Diegan Sage Scrub (H32500, K30, no SAF)	SS
Pacific Southern Mixed Chaparral (H37122, K29, no SAF)	MC
Scrub Oak Chaparral (H37900, K29, no SAF)	SO
Valley Needlegrass Grassland (H42110, K41, no SAF)	M
Freshwater Seep (H45400, no K or SAF)	Fs
Southern Coast Live Oak Riparian Forest (H61310, K26, SAF 255)	q
White Alder Riparian Forest (H61510, no K or SAF)	W
Open Engelmann Oak Woodland (H711810, no K or SAF)	EO
Canyon Live Oak Forest (H81320, K26, SAF249)	CO
Southern Interior Cypress Forest (H83330, no K or SAF)	all black
Coulter Pine Forest (H84140, no K or SAF)	CP

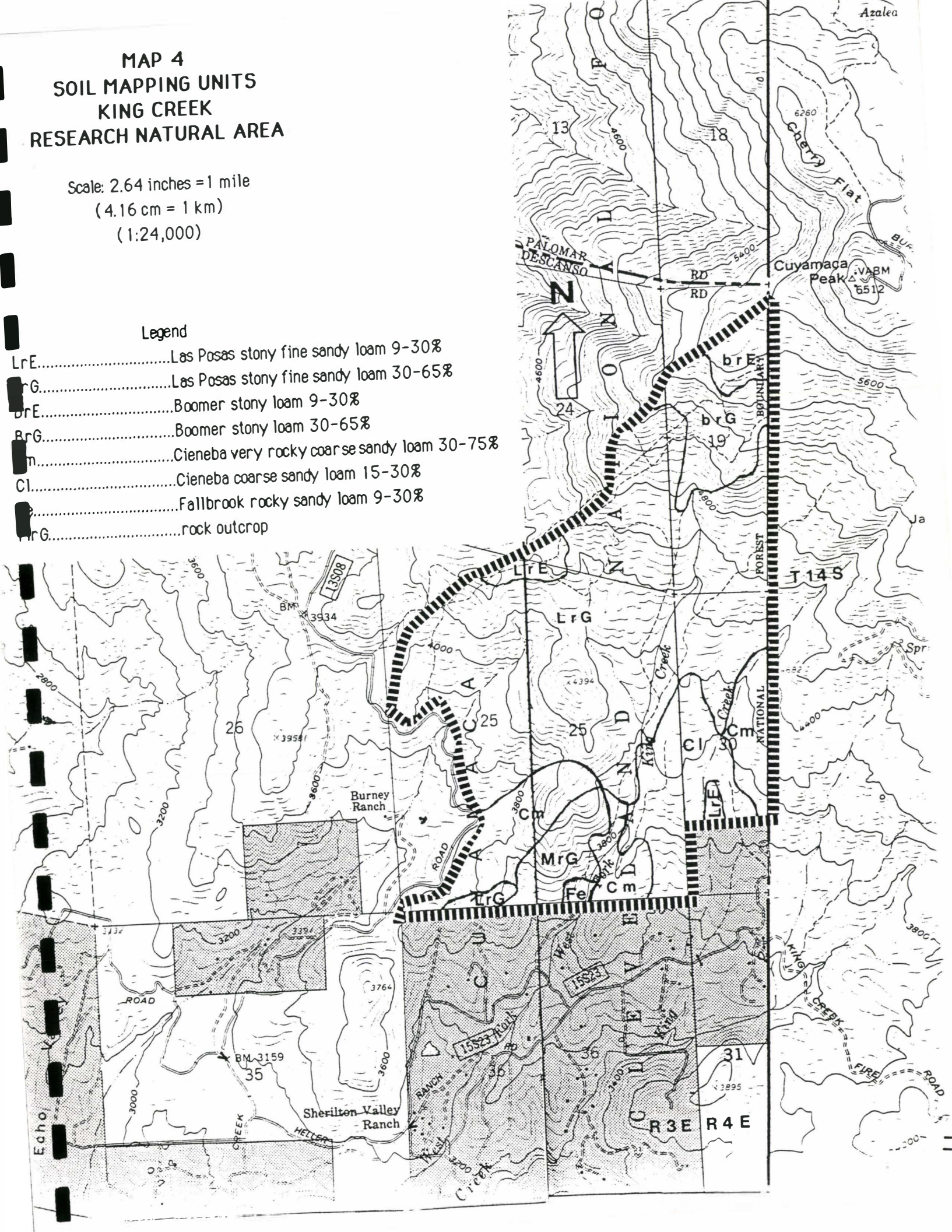


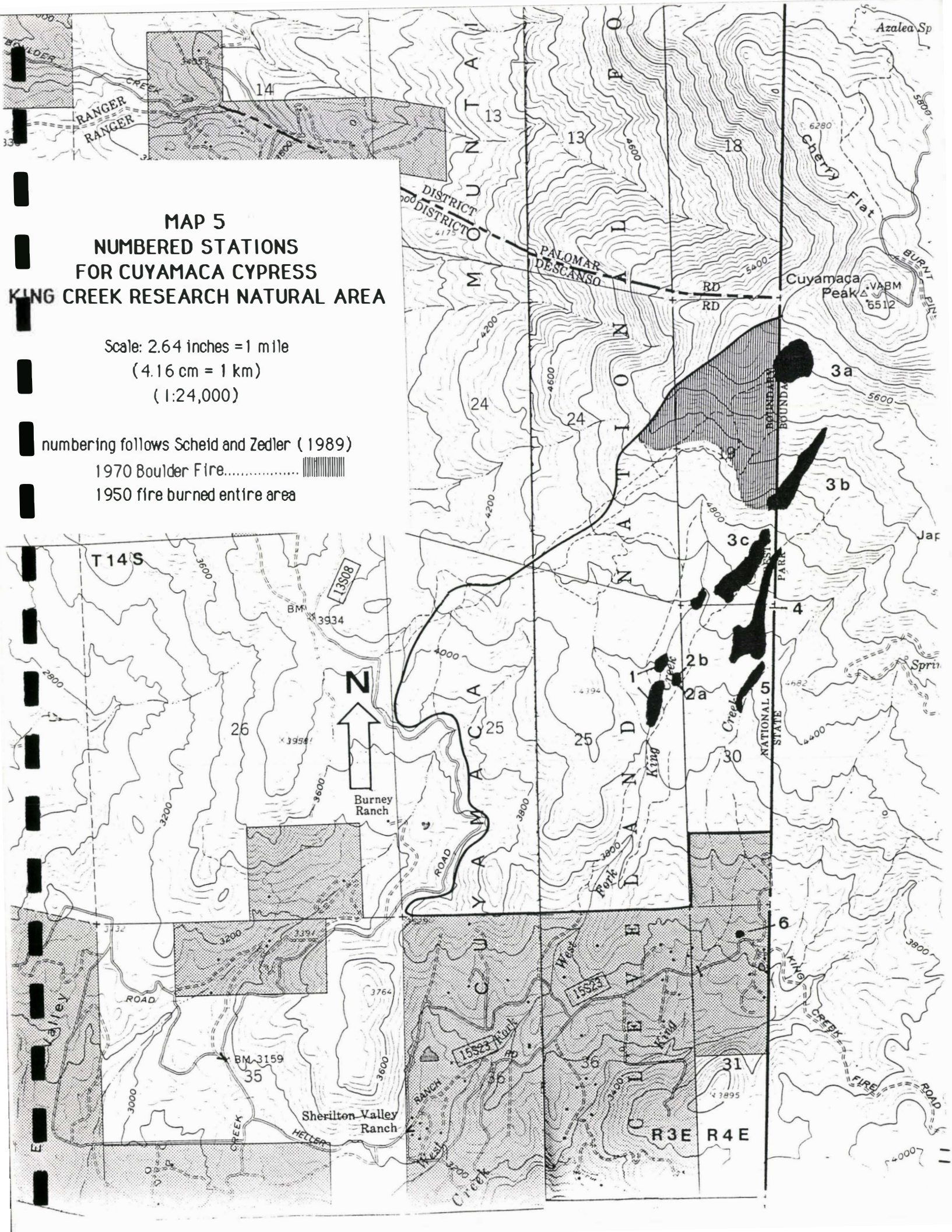
MAP 4
SOIL MAPPING UNITS
KING CREEK
RESEARCH NATURAL AREA

Scale: 2.64 inches = 1 mile
(4.16 cm = 1 km)
(1:24,000)

Legend

LrE.....Las Posas stony fine sandy loam 9-30%
rG.....Las Posas stony fine sandy loam 30-65%
BrE.....Boomer stony loam 9-30%
BrG.....Boomer stony loam 30-65%
m.....Cieneba very rocky coarse sandy loam 30-75%
Cl.....Cieneba coarse sandy loam 15-30%
.....Fallbrook rocky sandy loam 9-30%
rG.....rock outcrop




MAP 5
NUMBERED STATIONS
FOR CUYAMACA CYPRESS
KING CREEK RESEARCH NATURAL AREA
Scale: 2.64 inches = 1 mile
(4.16 cm = 1 km)
(1:24,000)
numbering follows Scheid and Zedler (1989)
1970 Boulder Fire.....
1950 fire burned entire area
3a
3b
3c
2a
2b
1
4
5
6
N
T14S
R3E
R4E
Cuyamaca Peak
VABM
6512
Burney Ranch
Sherilton Valley Ranch
BM 3159
BM 3934
PALOMAR
DESCANSO
DISTRICT
RD
RANGER
ROAD
CREEK
King Creek
West Fork
Cherry Flat
Azalea Sp
Jar
Spri
Valley
Creek
FIRE
ROAD
STATE
PARK
BOUNDARY
CUYAMACA
CLEVELAND
NATIONAL
MONUMENT

MAP 6
PROPOSED BOUNDARY CHANGE
KING CREEK
RESEARCH NATURAL AREA

Scale: 2.64 inches = 1 mile
(4.16 cm = 1 km)
(1:24,000)

Shaded area indicates addition
based on topographic boundary

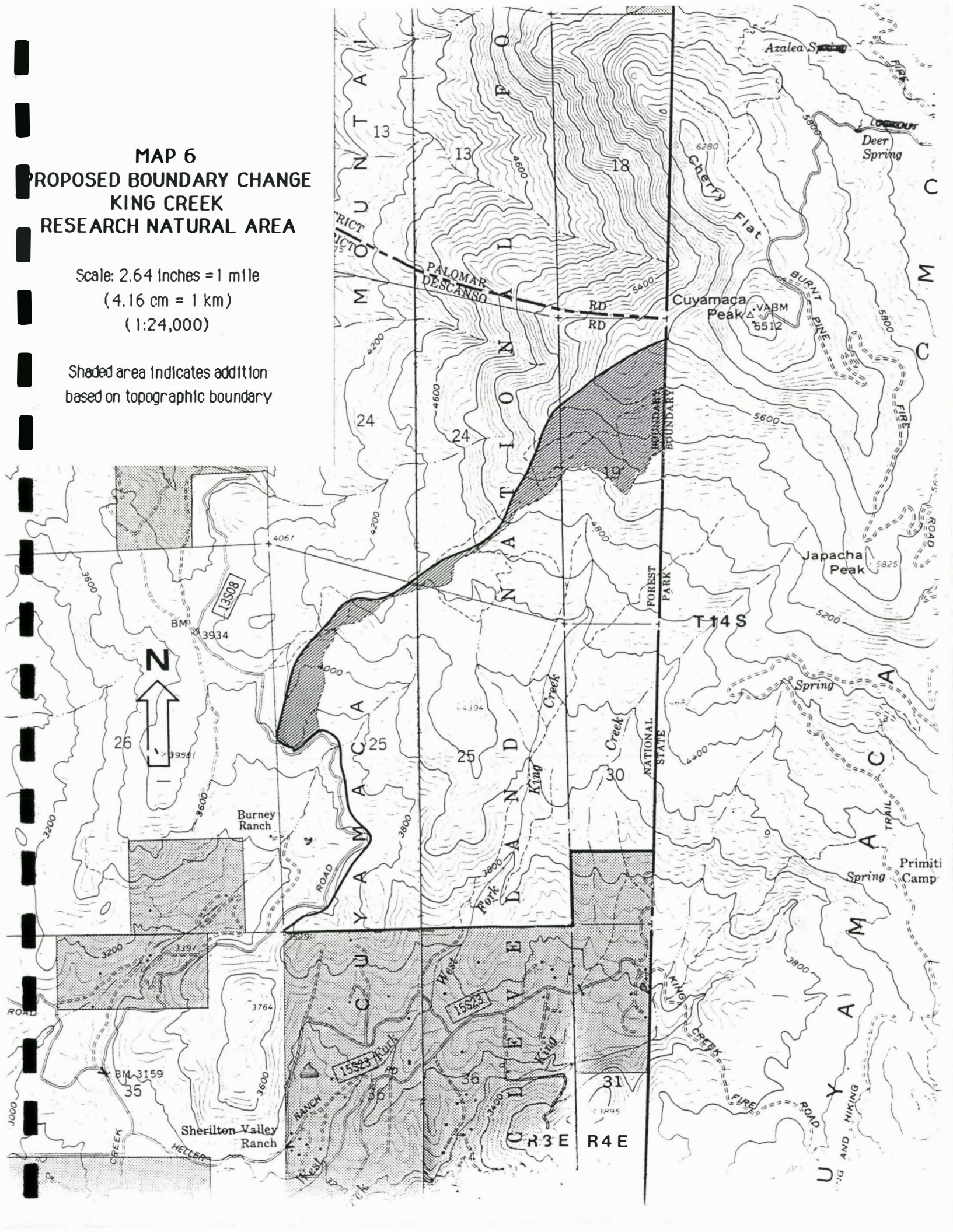


Photo Captions for
King Creek Ecological Survey

Photo 1). A portion of a typical chaparral stand of Cuyamaca cypress originating from the 1950 fire. Trees are between 6 and 9 ft. tall, view is to the southwest from the middle of stand 3c (see map 5).

Photo 2). Moist streamside stand of Cuyamaca cypress adjacent to flowing part of West Fork King Creek, tufted species in foreground is *Carex spissa*.

Photo 3). A carpet of the showy *Linanthus dianthiflorus* (ground pink), in the lower meadow adjacent to private land, April 20, 1990.

Photo 4). The San Diego horned lizard, a State species of special concern photographed on a gabbro boulder on the divide between the West and Main King Creek forks April 20, 1990.

Photo 5). *Calamagrostis densa*, a Cleveland National Forest sensitive plant, common in the southern mafic mixed chaparral of the RNA.

Photo 6). Lilium parryi, the lemon lily, in characteristic habitat along semi-shaded drainage beneath coast live oaks.

Photo 7). A carpet of creeping sage (*Salvia sonomensis*), covering opening in southern mafic mixed chaparral along northern boundary ridge (April 17, 1990).

Photo 8). Low, open habit of southern mafic mixed chaparral on south-facing slopes. Note skeleton of Eastwood manzanita and short resprouts in foreground. Fire occurred 40 years ago.

Photo 9). Low cover and stunted growth of southern mafic mixed chaparral at high saddle near northeastern corner of RNA. This area was burned in 1970 and is adjacent to cypress station 3a (map 5).

Photo 10). Open stand of Coulter pine in area of low growing southern mafic mixed chaparral. Flowerning shrub in foreground is *Ceanothus greggii* ssp. *perplexans*.

Photo 11). Dense stand of young Coulter pine averaging 29 years old. Elevation about 4400 ft. along northwest boundary.

Photo 12). Small patch of Diegan sage scrub adjacent to meadow along lower West Fork drainage. Dominant silvery shrub is *Salvia apiana*.

Photo 13). One of the large old Cuyamaca cypress growing along the West Fork within a foot of the stream channel. Basal diameter is about 28 inches.

Photo 14) Clusters of cones on Cuyamaca cypress on west-facing aspect in station 3c.

Photo 15). Seedling of Cuyamaca cypress beneath Eastwood manzanita on northwest-facing aspect (station 3c). Height of seedling ca. 4 inches.

Photo 16). One of the larger meadows along the lower West Fork, dominated by Stipa sp.

Photo 17). Well-developed coast live oak riparian forest along intermittant stream channel tributary to West Fork. Dominant understory shrub is *Symphoricarpos mollis*.

Photo 18). Savanna-like clump of Engelmann oak and coast live oak at edge of one of the large lower West Fork meadows.

Photo 19). White alder riparian growth along a flowing stretch of the West Fork of King Creek.

Photo 20). Characteristic tall rank herbaceous vegetation of freshwater seep including *Oenothera elata* and *Solidago confinis* (April 20, 1990).

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DATE DUE

QH76.5
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K466
1990

KEELER-WOLF, TODD

An ecological survey of the King Creek research natural area, Cleveland National...

DATE	ISSUED TO

INFO-PSW
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